Wallops Flight Facility
Range User's Handbook

Revision 1

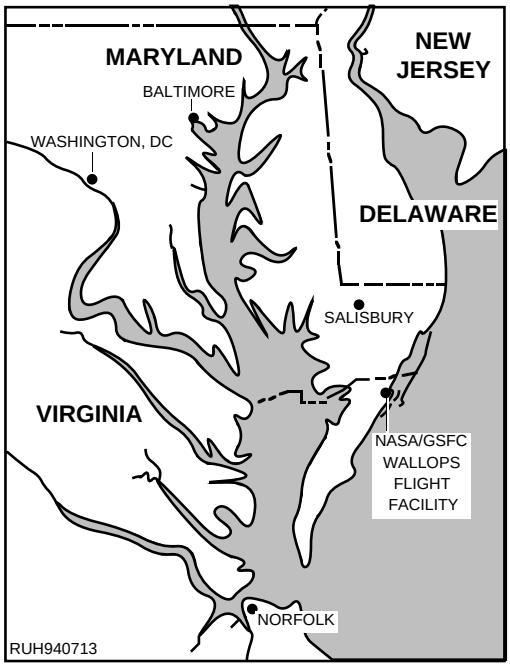
November 1996

National Aeronautics and Space Administration

Goddard Space Flight Center
Wallops Flight Facility
Wallops Island, Virginia 23337

Preface

The NASA/Goddard Space Flight Center (GSFC) operates the Wallops Flight Facility (WFF), located on the Eastern Shore of Virginia. NASA supports space and earth science technology and aeronautical research missions through the use of rockets, balloons, and aircraft. In support of these activities, WFF operates a Test Range consisting of a rocket range and research airport. Because of unique scientific requirements, WFF also maintains capabilities to conduct mobile launch activities. Wallops Users represent NASA, other United States Government agencies, foreign and commercial organizations. This *WFF Range User's Handbook* summarizes Wallops' policies and procedures for facility use and provides a description of general capabilities.



Additional copies of this *WFF Range User's Handbook* can be obtained from the Head, Sounding Rocket and Range Management Branch (Code 832), NASA, GSFC/Wallops Flight Facility, Wallops Island, Virginia 23337-5099.

Abbreviations and acronyms in the Handbook are listed in Appendix A. Detailed technical information regarding the Test Range instrumentation and facilities is contained in documentation listed in Appendix B.

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This is revision 1 of the *WFF Range User's Handbook*, dated November 1996.

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Range User's Handbook
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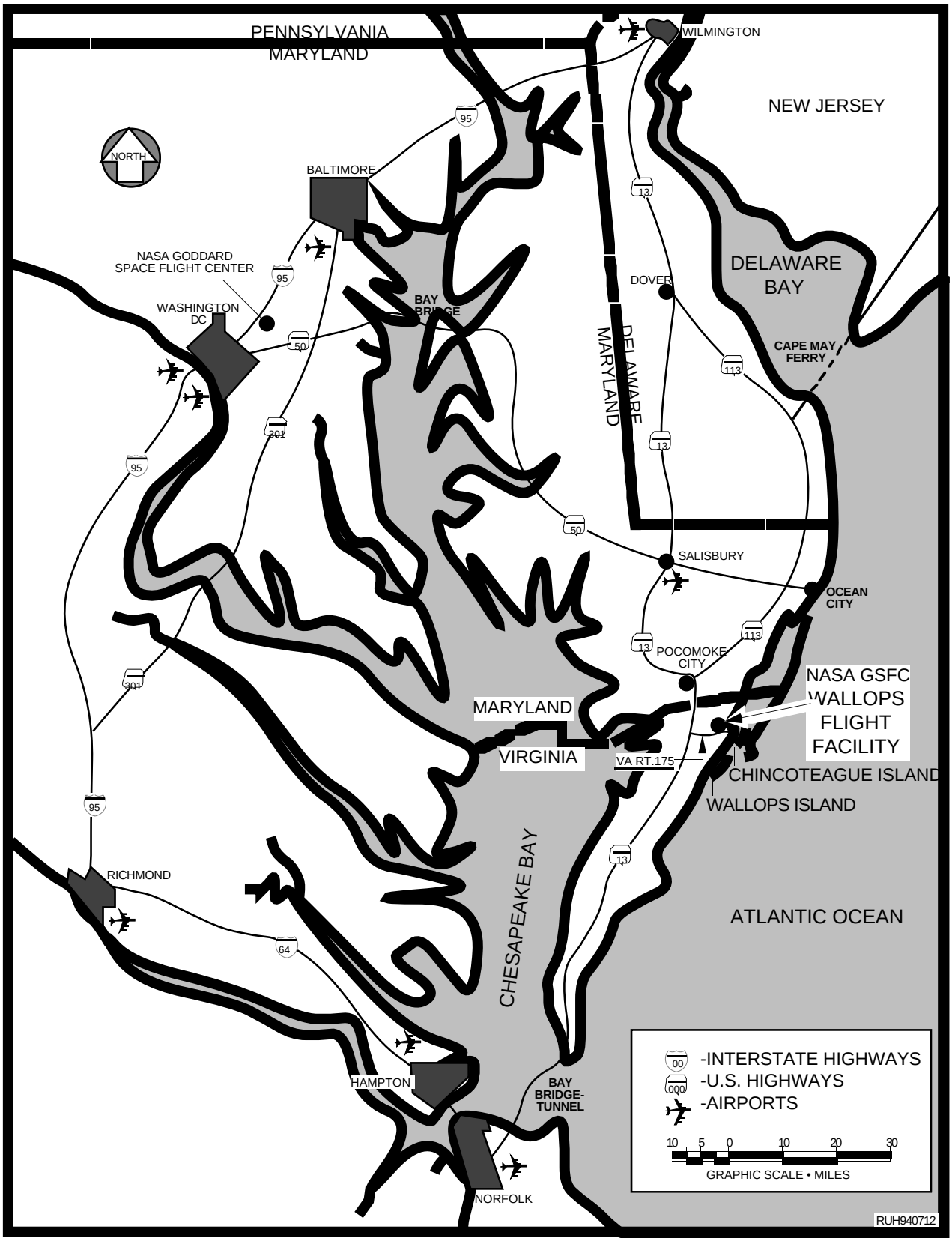

Road Map to NASA/GSFC/Wallops Flight Facility

Section One: Introduction

1.1 Purpose

This *Range User's Handbook* is a guide for planning operations at the Wallops Test Range. It provides a summary of the policies, procedures, and capabilities of the Range. Included are procedures for obtaining authorization for Range use and for efficient project coordination between the Range User and Wallops personnel.

This Handbook prescribes the information to be provided by the Range User that will enable the Test Range to effectively plan for and support the Range User's project. In addition, this Handbook describes the facilities and systems available at Wallops Flight Facility (WFF) for supporting aeronautical research, balloons and suborbital and orbital research projects.

Visit the WFF Home Page at http://www.wff.nasa.gov/ and the Major Facilities Inventory Home Page, http://131.182.171.171/ for additional information regarding WFF.

1.2 Geography

The WFF Main Base is located on Virginia's Eastern Shore 5 miles west of the town of Chincoteague, Virginia, at geographical coordinate 37 degrees 56 minutes north latitude, and 75 degrees 28 minutes west longitude. It is approximately 90 miles north of Norfolk, Virginia, and 40 miles southeast of Salisbury, Maryland. WFF consists of three separate sections of real property:

- the Main Base
- the Mainland Site
- the Wallops Island Launch Site

The Mainland Site and the Wallops Island Launch Site are approximately 7 miles southeast of the Main Base. Figure 1-1 shows WFF and the relationship between the Main Base, Mainland, and Wallops Island Launch Site.

1.3 Wallops Test Range

The Wallops Test Range is a part of the WFF and is managed by the Goddard Space Flight Center's (GSFC) Suborbital Projects and Operations Directorate. The Range consists of a launch range, an aeronautical Research Airport, and associated tracking, data acquisition, and control instrumentation systems. Included in the Range are authorized operating space, primarily over the Atlantic Ocean, and authorized radio frequency spectrum. Scientists and engineers from NASA, other United States Government agencies, colleges and universities, commercial organizations, and the worldwide scientific community have conducted experiments at the Range.

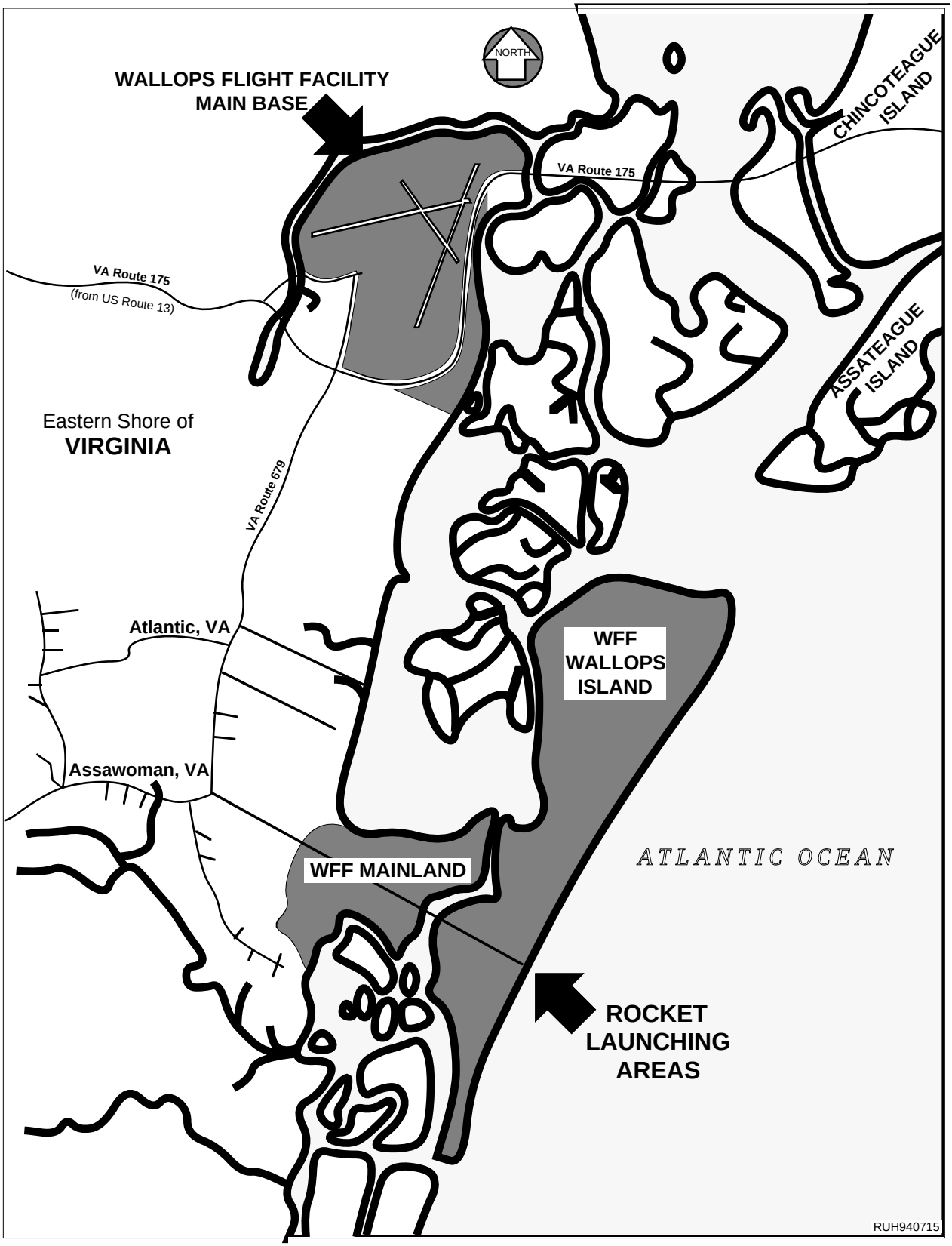

Figure 1-1. Major Areas: Wallops Flight Facility

1.4 GSFC/WFF Mission

The primary missions conducted at GSFC/WFF include:

a. manage and implement the NASA Sounding Rocket and Balloon Programs

b. conduct observational earth sciences studies

c. provide aircraft flight services to support observational sciences studies

d. operate the Wallops Test Range in support of these and other activities

e. provide orbital tracking support

f. support operations at remote sites conducting scientific missions.

Note that this Handbook only addresses missions related to the Wallops Test Range.

1.5 GSFC at WFF

There are four GSFC directorates located wholly or in part at WFF. These are the:

• Suborbital Projects and Operations Directorate (Code 800) which is wholly located at WFF. See Figure 1-2 for the Code 800 organizational chart. One of the primary functions of Code 800 is managing the Wallops Test Range. The Suborbital Projects and Operations Directorate (Code 800) elements supporting the Range are:

  • Engineering and Safety Division (Code 820): Develop and construct instrumentation, mechanical and electronic systems, and provide safety and quality and assurance support.

  • Program and Mission Management Division (Code 830): Operate the Test Range, earth sciences aircraft, Wallops Orbital Tracking Station, and conduct mobile operations and manage the NASA Sounding Rocket Program and the Balloon Program.

  • Resources Management Office (Code 801): Plan and monitor execution of all budgets including R&D, institutional, reimbursable, manpower and travel.

  • Policy and External Relations Office (802): Plan and manage space launch commercialization activities.

• Office of Human Resources - Wallops Office (Code 111.3) and the Wallops Public Affairs Office (Code 130) of the Office of Public Affairs are under the Office of the Director, GSFC (Code 100). Wallops Fiscal Operations Section (Code 151.2) provides financial services, e.g. payroll, travel, imprest funds.

• Management Operations Directorate (Code 200) has elements at WFF providing facilities management, facilities construction, environmental, security, health and logistics services.

• Laboratory for Hydrospheric Processes Resources Support Office (Code 903) and all of the Observational Science Branch (Code 972) of the Earth Sciences Directorate (Code 900) are located at WFF. These organizations perform observational science research and are co-located with GSFC research assets such as aircraft, instrumentation, and technical shops.

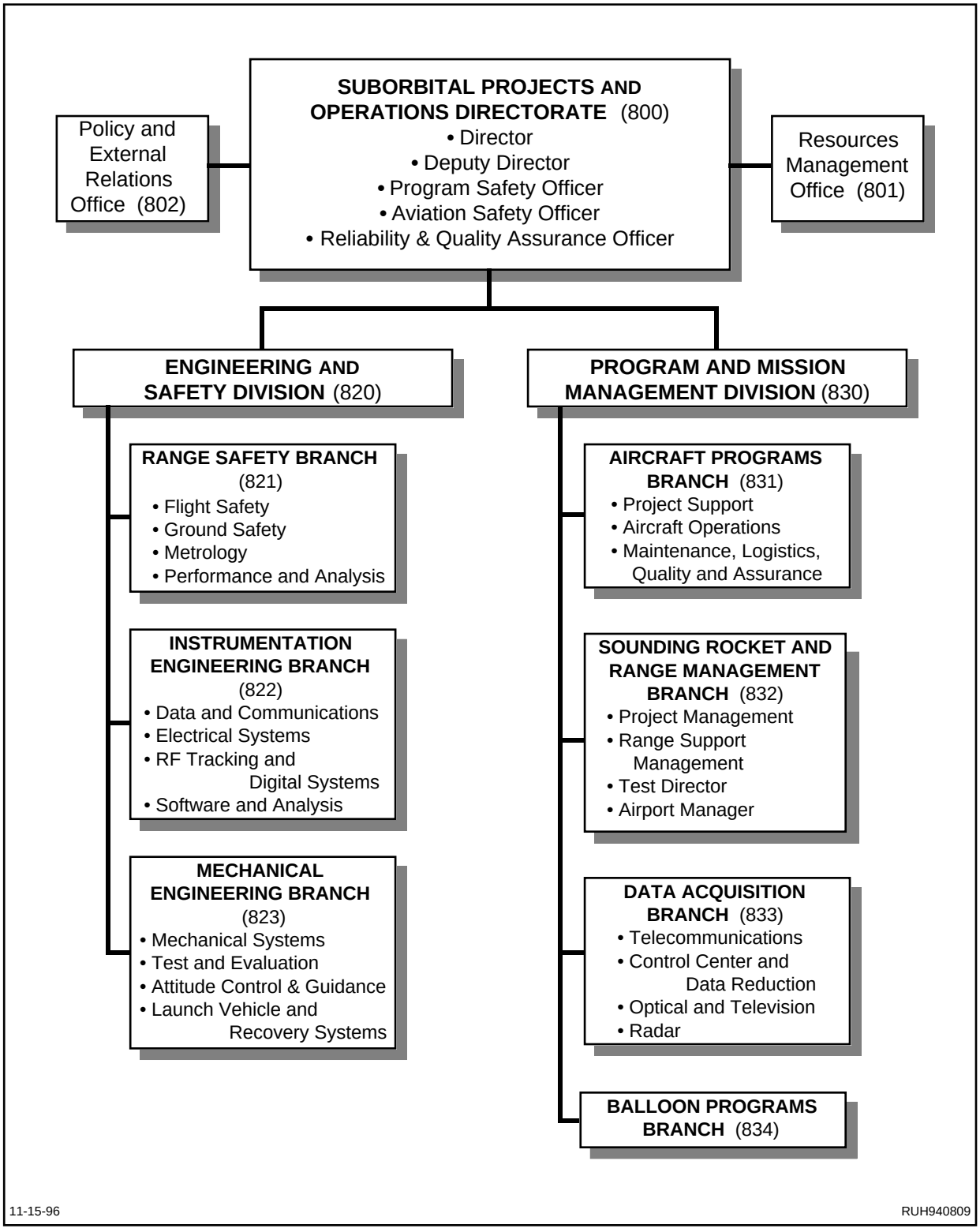

Figure 1-2. Suborbital Projects and Operations Directorate (800)

These organizational elements combine to form the WFF and perform all the functions for the operation of the Facility.

WFF supports two other ranges through contract management, instrumentation, and other range support as may be required. The two ranges are the:

- Poker Flat Research Range (PFRR), Alaska, maintained and operated by The Geophysical Institute, University of Alaska, Fairbanks, Alaska.
- The National Scientific Balloon Facility (NSBF), Palestine, Texas, maintained and operated by the Physical Science Laboratory of New Mexico State University.

There are also several tenant organizations at WFF including organizations from the Naval Surface Weapons Center Dahlgren Division, the AEGIS Combat Systems Center, the National Oceanic and Atmospheric Administration, and the United States Coast Guard.

1.6 Operational History

In 1945, NASA's predecessor agency, the National Advisory Committee for Aeronautics (NACA), established a launch site on Wallops Island under the direction of the Langley Research Center. This site was designated the Pilotless Aircraft Research Station and conducted high speed aerodynamic research to supplement wind tunnel and laboratory investigations into the problems of flight. When Congress established the National Aeronautics and Space Administration (NASA) in 1958 and absorbed Langley Research Center and other NACA field centers and research facilities, the Pilotless Aircraft Research Station became a separate facility - Wallops Station - operating directly under NASA Headquarters in Washington, D. C. In 1959, NASA acquired the former Chincoteague Naval Air Station and engineering and administrative activities were moved to this location. In 1974, the Wallops Station was named Wallops Flight Center. The name was changed to Wallops Flight Facility in 1981, when it became part of Goddard Space Flight Center, Greenbelt, Maryland.

In the early years, research at Wallops was concentrated on obtaining aerodynamic data at transonic and low supersonic speeds. Between 1959 and 1961, Project Mercury capsules were tested at Wallops in support of NASA's manned spaceflight program before the astronauts were launched from Cape Canaveral, Florida. Some of these tests using the Little Joe Booster were designed to flight quality components of the Mercury spacecraft, including the escape and recovery systems and some of the life support systems. Two rhesus monkeys, Sam and Miss Sam, were sent aloft acting as pioneers for the astronauts; both were recovered safely.

Since 1945, The Wallops Test Range has launched thousands of research vehicles in the quest for information on the flight characteristics of airplanes, launch vehicles, and spacecraft, and to increase the knowledge of the Earth's upper atmosphere and the near space environment. The

launch vehicles vary in size and power from the small Super Loki meteorological rockets to orbital class vehicles.

The WFF continues to be a small, fast response, matrix organization which can accomplish rocket and balloon projects, spacecraft orbital tracking, airborne science support, and aeronautical research.

1.7 Key Range Personnel

All operations at the Test Range are conducted under NASA control. The terminology in the following paragraphs define the functions, responsibilities, and authority of key range personnel. Appendix B lists commonly used abbreviations and acronyms.

1.7.1 WFF Test Director

The WFF Test Director has authority over all operations conducted on the Wallops Test Range. The Test Director is responsible for assuring that all range policy, criteria, and external agreements are satisfied during the operations.

1.7.2 Range Support Manager (RSM)

The RSM is the primary point of contact for the Range User. The designated WFF RSM is responsible for the planning, coordinating, and directing of operational support for assigned projects conducted at the Wallops Test Range. The RSM also serves as Assistant Test Director. The RSM is usually identified during the mission/project acceptance process by WFF management and is given authority to plan and implement required support during the lifetime of the program.

1.7.3 Range Safety Officer (RSO)

The WFF RSO is responsible for assuring the Wallops Test Range safety policy, criteria, and procedures are not violated during operations and to ensure that risks are understood and are within acceptable limits. The RSO has authority to stop work, hold a launch, or terminate a mission in flight if necessary.

1.7.4 Operations Safety Supervisor (OSS)

The OSS is responsible for supervising all assigned potentially hazardous operations. The OSS is also responsible for implementation of Ground Safety Plans and operating procedures. In some instances, the OSS may delegate responsibilities to other qualified personnel for specific operations.

Section Two: Wallops Test Range Support Procedures

2.1 Introduction

This section outlines the polices and procedures for conducting a project at the Wallops Test Range. Use of the Range and its associated support facilities is primarily guided by the NASA Goddard Space Flight Center Management Instruction GMI 1300.2, *Policies and Procedures for the Use of the Goddard Space Flight Center/Wallops Flight Facility (GSFC/WFF) Test Range.*

The National Aeronautics and Space Act of 1958 (Space Act), as amended, charters NASA to plan, direct, and conduct space activities. The Space Act authorizes NASA field installations to establish policies and operational interface procedures for all Users of NASA resources. Activities under the Space Act are to be conducted to optimize America's scientific and engineering resources. NASA is authorized to enter into contracts, leases, cooperative agreements, and other transactions on such terms as it may deem appropriate with any person, firm, association, or corporation. NASA is also authorized to cooperate with public and private agencies in the use of Government-provided launch support, services, equipment, and facilities.

2.2 Policies

2.2.1 Safety, Reliability and Quality Assurance Policy

All activities conducted on the Wallops Test Range will be reviewed by WFF safety personnel and must be conducted in accordance with safety policy and criteria established in GMI 1700.2B, *Goddard Space Flight Center Health and Safety Program*; GMI 1771.1, *Range Safety Policies and Criteria for Goddard Space Flight Center (GSFC)/Wallops Flight Facility (WFF);* and the *Range Safety Manual for GSFC/WFF* and supplements. Reliability and Quality Assurance reviews may be required on a case by case basis.

2.2.2 Frequency Utilization and Management

The WFF Test Director (Code 832) is responsible for the operational control of the RF spectrum at WFF.

Frequency utilization and management policies and procedures applicable to all Range User activities at WFF are detailed in the *GSFC/WFF Host/Tenant Frequency Utilization Management Manual.*

2.2.3 Scheduling

The Office of the Test Director (Code 832) is responsible for establishing and maintaining the schedule of Range activities. This includes publishing schedules and summaries, resolving scheduling conflicts between project requirements and resources, and acquiring required clearances from external organizations for programs conducted at the Range.

Program scheduling information is submitted by the Range User to the RSM. Potential conflicts are relayed by the RSM to the Range User as they are identified. Every effort is made to resolve conflicts between programs in a manner that permits each program to be successfully completed on an acceptable schedule.

Scheduling meetings are held monthly and the updated schedule is published and distributed. Activity schedules are updated as new information becomes available and maintained on a computer database which is accessible through remote terminals. A calendar format schedule, covering the upcoming four weeks, is published weekly. The daily schedule is announced on the WFF paging system at 0830 and 1600 local time.

Clearances required for airspace and oceanic impact areas are acquired and coordinated by the Wallops Test Director with the Federal Aviation Administration (FAA), North American Aerospace Defense Command (NORAD), Fleet Area Control and Surveillance Facility (FACSFAC), and the United States Coast Guard. Information for these clearances must be submitted by the Range User to the RSM at least 2 weeks in advance of the required time to facilitate approval and scheduling.

2.2.4 Environmental Requirements

The Wallops Environmental Branch (Code 205.3) of the Safety, Environmental and Security Office (Code 205.0) serves as the clearinghouse for National Environmental Policy Act (NEPA) compliance at WFF.

In most cases, WFF has approved environmental documentation covering Range User's activities at WFF. The WFF Environmental Resources Document (ERD) provides the required environmental documentation for all Wallops "in house" activities and also provides the required documentation for many of the Range User activities. However, early in the project, the RSM will discuss environmental requirements with the Range User to identify potential environmental issues. In consultation with the Wallops Environmental Branch (Code 205.3), a determination will be made of any formal documentation required.

2.3 Project Approval and Interface Procedures

2.3.1 Introduction

The Range User should confer with Wallops personnel prior to the submission of a formal request to determine the feasibility of conducting the proposed mission/project at the Wallops Test Range.

The first point-of-contact by the Range User should be with the Sounding Rocket and Range Management Branch (Code 832), telephone (757) 824-1955 or 824-1613. The initial contact will normally lead to a meeting between Range User and WFF technical personnel to exchange preliminary information and to reach a tentative position on the feasibility of conducting the mission/project at the Range. The procedures to be followed subsequent to establishing feasibility depend on the User's organizational affiliation as noted in the following paragraphs.

2.3.2 United States Government Agencies

After agreement on the feasibility of a project, a formal letter requesting support should be sent by the Range User to the Director, Suborbital Projects and Operations Directorate (SPOD) (Code 800). The formal request should provide a brief overview of the support required, the safety aspects, and the operational requirements of the project.

WFF acceptance will normally take the form of a letter from the Director, SPOD (Code 800), to the Range User. The letter of approval will identify the RSM, project support conditions, and the estimated project support cost. Other documentation requirements are listed in paragraph 2.4. Projects which require long-term User presence at WFF, multiple mission support efforts, or User constructed facilities at WFF may require more formal documentation such as a Memorandum of Agreement (MOA) or a Host-Tenant Agreement (HTA).

2.3.3 Commercial Organizations and Foreign Governments

Procedures are similar to United States Government Users, except that a MOA is always required.

2.3.4 CSLA - Commercial Space Launch Act Organizations

Procedures established by NASA for obtaining NASA facilities and services for support of CSLA activities require the User to obtain a formal agreement with NASA Headquarters. Once an agreement between the CSLA Range User and NASA Headquarters is in place, a sub-agreement will be necessary between the User and GSFC. Individual Support Annexes (ISA) with

GSFC/WFF are also required to establish support requirements and costs for each individual launch or activity.

The first contact for potential CSLA Range Users desiring access to the Wallops Test Range is the Chief, Policy and External Relations Office (Code 802). This office can be reached by calling (757) 824-1479.

2.3.5 Operational Interface

After the necessary agreements are established, the primary interface between the Range User and the Wallops Test Range will be the assigned RSM.

2.4 Technical Data Requirements

2.4.1 Program Requirements Document (PRD)

The Range User's project description and technical requirements are conveyed to the Wallops Test Range through use of a PRD.

WFF has adopted a modified PRD format from the Universal Documentation System (UDS) for documenting the support requirements at the Test Range. The UDS is the standardized documentation system that is accepted and used at ranges operated by the Department of Defense. It provides a common format for stating requirements and preparing support responses. The primary UDS reference is the *Range Commanders Council - Documentation Group (RCC-DG) Document 501-90, Volumes I, II, and III*.

Projects at the Test Range span a broad spectrum of complexity and some flexibility in the application of PRD standards is necessary. However, the PRD provides an excellent checklist of information needed for projects conducted at the Range. The PRD will normally contain all of the information needed.

2.4.2 Safety Data

The Range Users must also provide a safety data package with ground and flight safety information, specifications, performance and procedures for safety related items. The detailed information that must be included in the safety data package is identified in paragraph 8.0, *Range Safety Manual for GSFC/WFF.*

2.4.3 Operations and Safety Directive (OSD)

The OSD is prepared by the RSM and is NASA's response to the Range User's PRD. The OSD provides a description of the project, the detailed support configuration for all Wallops

equipment, instrumentation, and facilities. A Ground Safety Plan, Flight Safety Plan, Countdown, and special procedures, as appropriate, are included.

2.4.4 Additional Documentation Requirements

A Mission Requirements Request (MRR) and a Detailed Mission Requirements Document (DMR) may also be required for some missions. The WFF staff will assist the Range User in the preparation of the MRR and DMR.

2.4.5 Documentation Schedule

WFF attempts to avoid excessive documentation wherever possible. Range Users are required to provide a PRD to aid WFF in defining support requirements. Only applicable sections need be provided. Required documentation with generalized publication dates for first-time projects are listed below.

- Program Requirements Document (PRD) 90 days prior to arrival at WFF
- *Mission Requirements Request T-1 year
- *Detailed Mission Requirements T-90 days
- Preliminary Range Safety Data Package T-120 days
- Final Range Safety Data Package T-90 days
- Hazardous Procedures T-60 days
- Trajectory Simulation Data T-60 days
- Operations and Safety Directive T-21 days

* Orbital Missions only

Timelines can be compressed for small projects or expanded for orbital launch vehicles. Exact data requirements will be determined during the planning process based on schedule and project unique details. Earlier dates may be required if the Range User begins processing at WFF earlier than 30 days prior to launch.

WFF encourages Range Users to provide documentation as early as possible to assure adequate time for review and approval. Failure to do so could require unnecessary redesigns or delays in schedule.

2.4.6 Operational Reviews

WFF conducts premission reviews for all projects in order to assure that personnel are briefed on requirements and responsibilities and to assure that all necessary preparations have been satisfactorily completed. A synopsis of WFF reviews is included below.

- Range Readiness Review - A Range Readiness Review is conducted for all major operations. For this review, a panel is established to review the WFF support preparations.
- Premission Briefing - This mandatory briefing serves to assure all key personnel are prepared to support the operation and that participants understand roles, responsibilities, and operational details.
- Operation Debriefing - This post-operation meeting is intended to evaluate the operation and identify items requiring action prior to future operations.

Additional reviews may be required for large projects. In addition, it is highly recommended that range operations and safety personnel be invited to participate in project design reviews and technical interchange meetings in order to assure concerns are addressed early in the planning process.

2.5 Funding Information

Test Range facilities and operational support are available to support NASA projects, other United States Government Agencies, CSLA projects, commercial organizations, and, under certain circumstances, foreign governments. A project cost estimate will be provided by WFF for requested support. The User will be required to pay actual costs. Funding should be received by WFF at least 6 weeks prior to start of work on the project. Work cannot proceed until funding has been processed. Charges are established by the following guidelines:

- NASA Organizations - NASA projects are charged for project unique services.
- Other United States Government Agencies - Projects are charged for additive cost.
- CSLA Projects - CSLA Projects are charged for additive cost.
- Commercial Organizations and Foreign Governments - Full recovery of all costs.

Section Three: Wallops Test Range

3.1 Wallops Flight Facility

The WFF includes three areas on the Eastern Shore of Virginia shown in Figure 1-1. These are the Main Base, the Mainland Site, and the Wallops Island Launch Site.

3.1.1 Wallops Main Base

Figure 3-1 is an aerial view of Wallops Main Base, looking east. The Main Base is the location of many of the major functions and activities supporting the Test Range including:

- administrative offices
- technical service support shops
- Research Airport
- telemetry facility
- Wallops Orbital Tracking Station (WOTS)
- engineering support
- rocket inspection and storage area
- Range Control Center
- telecommunications center

The Main Base also supports several tenants including the National Oceanographic and Atmospheric Administration (NOAA), the United States Coast Guard (USCG), and United States Navy activities relating to the AEGIS Combat Systems Center and an office of the Dahlgren Division, Naval Surface Warfare Center (NSWC).

Figure 3-1**.** Aerial view of the Wallops Main Base

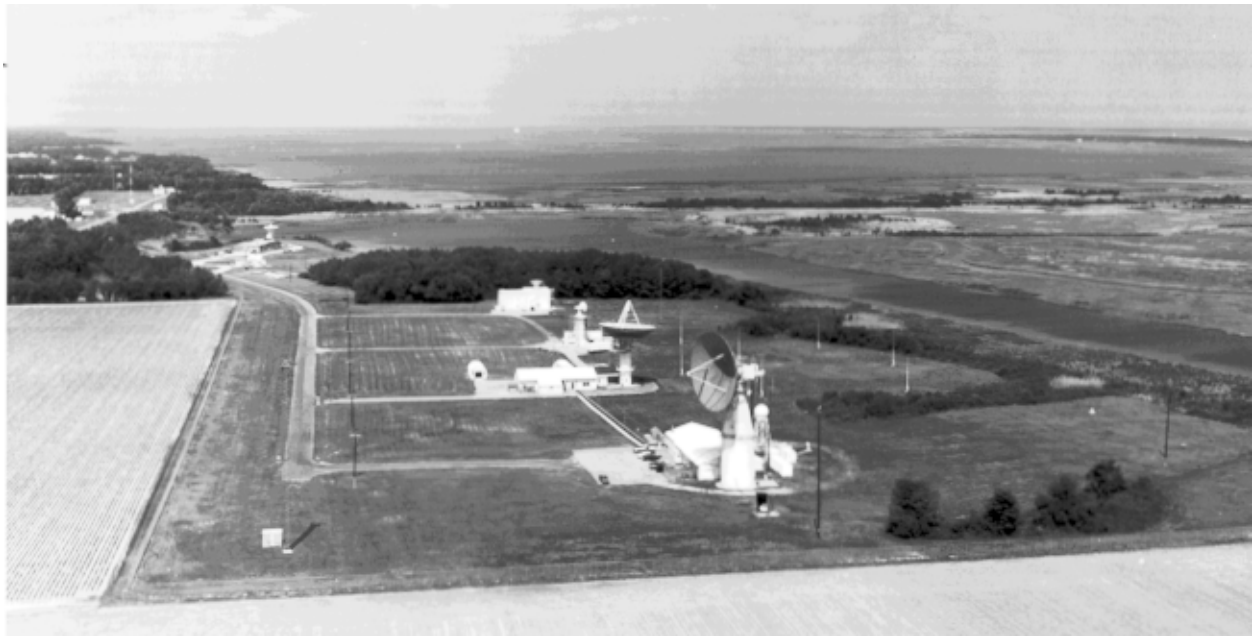

Figure 3-2. Aerial View of the Wallops Mainland

3.1.2 Mainland

The Mainland site is a strip of land located west of Wallops Island and is the location for radars, optical, communications, and command transmitter facilities. It is the site of the Atmospheric Sciences Research Facility (ASRF). Figure 3-2 is an aerial view of the Wallops Mainland, looking north.

3.1.3 Wallops Island

Wallops Island, named after John Wallop, a 17th Century surveyor, is an Atlantic Ocean barrier island off the coast of Virginia approximately 7 miles southeast of the Main Base. It is separated from the mainland by 2 miles of marsh and water. The Island, approximately 6 miles long and about one-half mile at its widest point, is connected with the Mainland by a causeway and bridge. The following facilities are located on Wallops Island:

- launch sites
- blockhouses
- radar facilities
- payload processing facilities
- United States Navy Aegis Combat Systems Center
- assembly shops
- dynamic balance facilities
- rocket storage buildings
- NSWC Ship Self Defense Engineering Center (SSDEC)

Figure 3-3 shows Wallops Island including an overview of the launch facilities, looking north.

Figure 3-3. Aerial View of Wallops Island

3.1.4 Wallops Test Range

The Wallops Test Range is located on the three separate sections of NASA controlled real property - the Main Base, Mainland, and Wallops Island. The Test Range is composed of:

a. the Wallops Island launch facilities

b. the Research Airport

c. supporting instrumentation

d. authorized space

e. authorized frequency spectrum

f. operations/support personnel

3.1.5 Authorized Space

The authorized space includes:

a. The GSFC/WFF Airport Control Zone: Airspace vertically to 2,500 feet in a 5 statue mile radius of the airport. The Control Zone has an arrival and departure corridor.

b. Restricted Area R-6604: Restricted airspace connecting WFF and offshore warning areas. It is shown in Figure 3-4.

c. Surface area and airspace extending from Restricted Area R-6604 into the offshore warning areas: The extended area varies with the particular mission/project activity and is limited to that area for which specific use has been cleared with the responsible agencies, e.g., Federal Aviation Administration (FAA) and United States Navy Fleet Air Control and Surveillance Facility (FACSFAC).

Figure 3-4 depicts the Wallops Test Range operating areas and authorized space.

3.1.6 Trajectory Options

WFF offers a wide array of launch vehicle trajectory options. The coastline of Wallops Island is oriented such that a launch azimuth of 135° is perpendicular to the shoreline. In general, launch azimuths between 90° and 160° can be accommodated depending on impact ranges. For most orbital vehicles, this translates into orbital inclinations between 38° and approximately 60°.

Trajectory options outside of these launch azimuths, including polar and sun-synchronous orbits, can be achieved by inflight azimuth maneuvers. For example, wider northerly options are possible by maneuver around Assateague Island after passing 5nm downrange. The North Carolina Outer Banks are generally the restricting landmass for southern launch azimuths. Specific trajectory options are determined through consultation with the Flight Safety Group (Code 821). The operational impact area is shown in Figure 3-5, and trajectory options are illustrated in Figure 3-6.

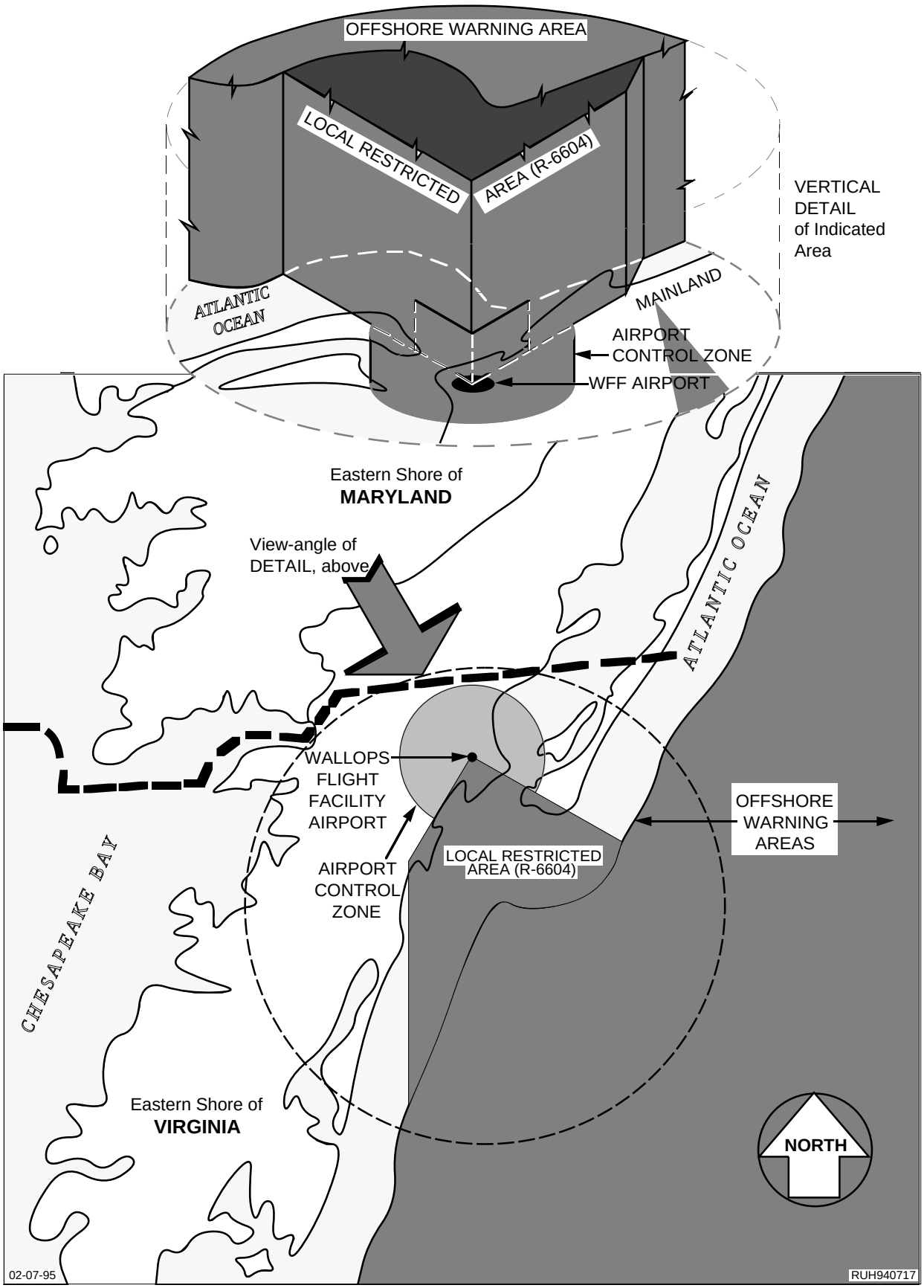

Figure 3-4. Wallops Test Range Authorized Space

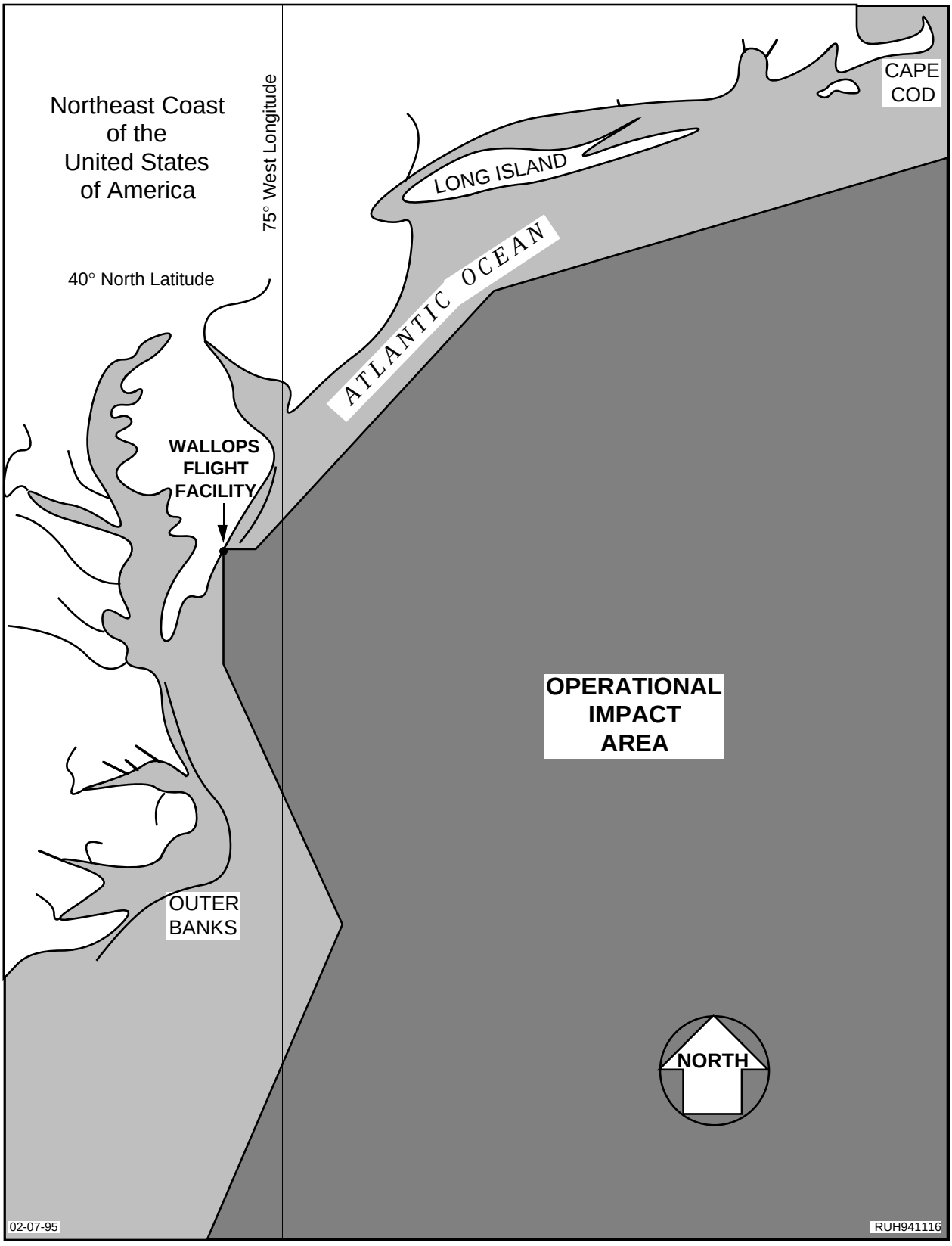

Figure 3-5. Operational Impact Area

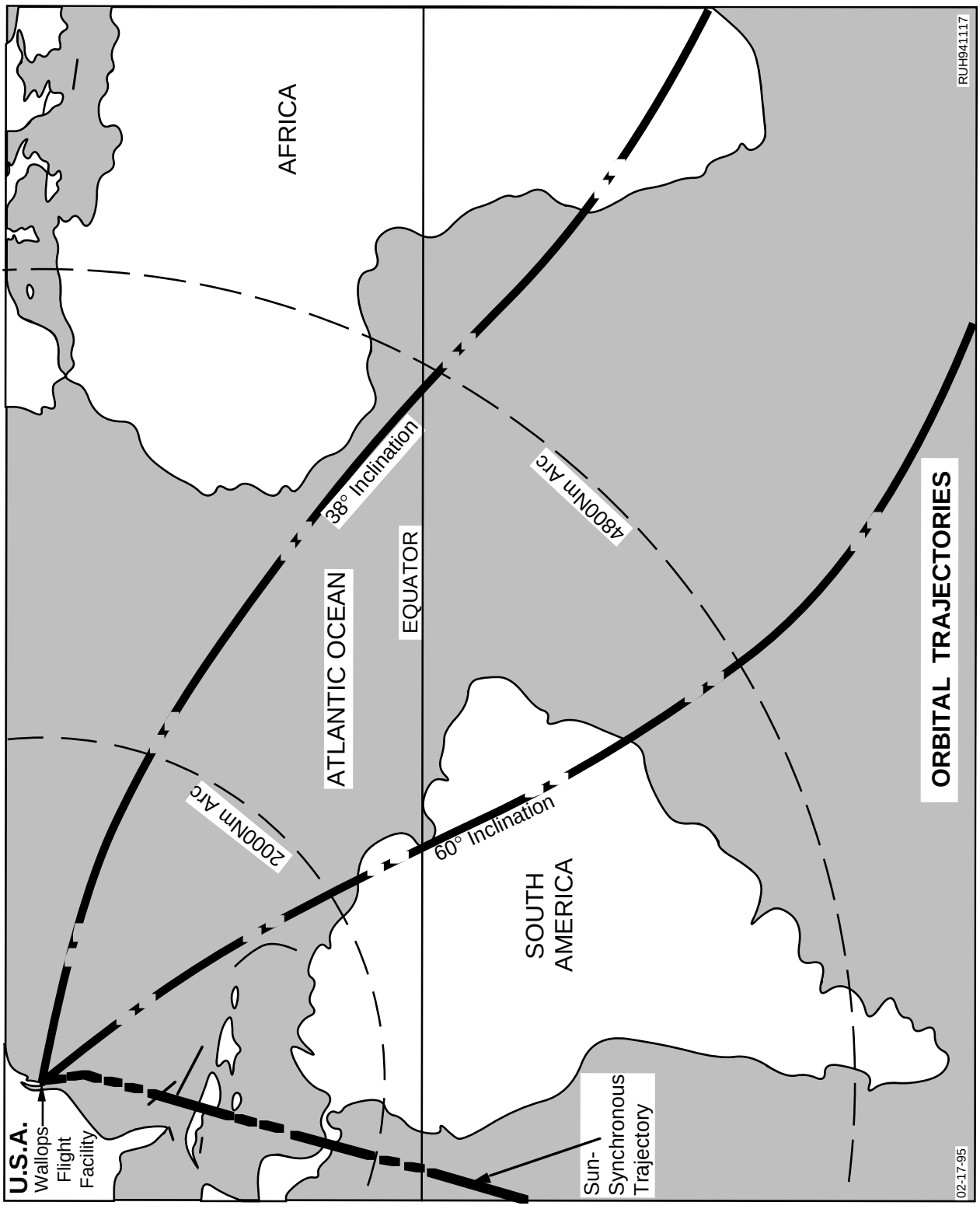

Figure 3-6. Orbital Trajectories

3.1.7 Wallops Weather

WFF enjoys a temperate climate and weather seldom interferes with launch and aeronautical operations. There are only a few months annually when cold weather can be a concern. In winter months, measures are taken to protect launch vehicles. As in most coastal regions, humidity can be relatively high; however, work areas are humidity controlled and humidity does not significantly affect operations at the Test Range.

Figure 3-7 shows annual temperatures and precipitation at WFF on a month-by-month basis. There are plots for mean high and mean low temperatures and annual variation. Extreme maximum and extreme low temperatures that have been experienced at WFF are noted. Also shown are average precipitation days and precipitation inches per month including snow averages.

There are two figures depicting surface wind conditions at WFF. Figure 3-8 shows average surface wind speed by month and notes the predominately northwest winds between October and April and the predominately southerly winds between April and October.

Figure 3-9 shows monthly wind roses depicting the various directions of the surface winds within concentric circles indicating occurrences at 5 percent, 10 percent, and 15 percent of the time.

The Test Range is supported by meteorological and weather data and forecasting capabilities which are described in this section:

- Paragraph 3.2.10.10 The Weather Forecast Office
- Paragraph 3.2.11 Meteorological Facilities
- Paragraph 3.2.12 Atmospheric Sciences Research Facility

3.2 Test Range Facilities

The Wallops Test Range has a variety of facilities supporting its operations. The major facilities are described in the following subsections. More detailed descriptions of many of the facilities and their capabilities are available in a series of Instrumentation Handbooks and related documentation. A list of available publications is shown in Appendix B.

3.2.1 Launch Facilities

WFF has facilities for the receipt, inspection, assembly, checkout, and storage of rocket motors and other pyrotechnic devices. The Wallops Island Launch Site is comprised of six launch pads, three blockhouses for launch control, and assembly buildings to support the preparation and launching of suborbital and orbital launch systems. Figure 3-10 is an annotated drawing of the Wallops Mainland and Wallops Island showing the location of support facilities and launch pads. Figure 3-2 shows an aerial view of Wallops Mainland and Figure 3-3 shows an aerial view of Wallops Island.

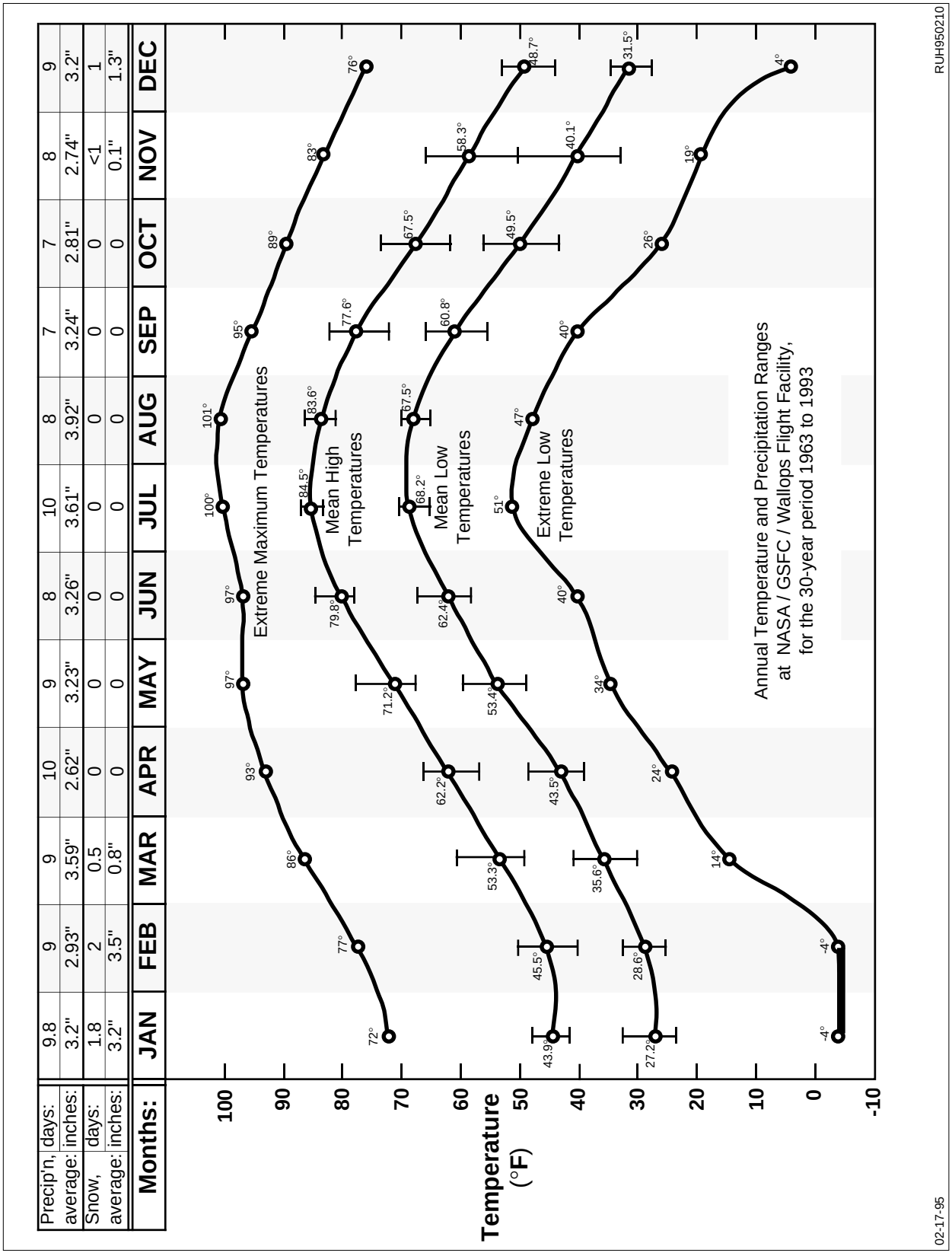

Figure 3-7. Annual Precipitation and Temperature Plot for Wallops Flight Facility

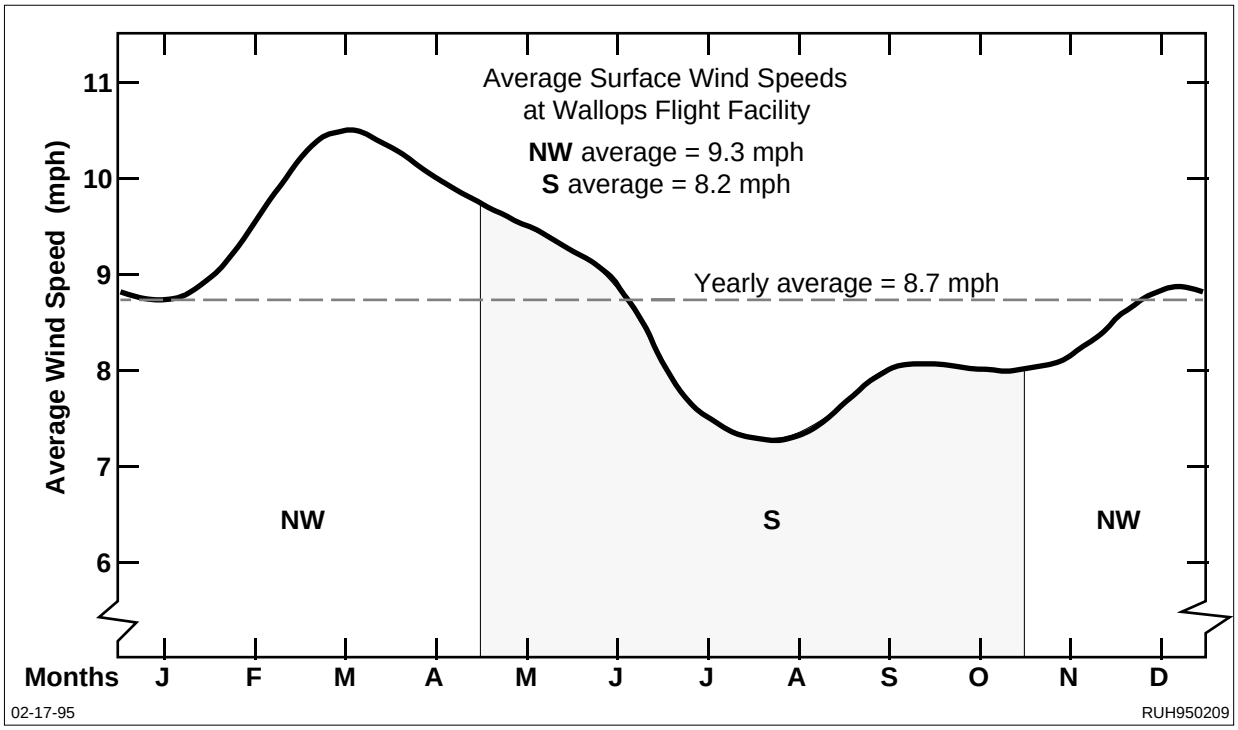

Figure 3-8. Average Surface Wind Speed at Wallops Flight Facility

Table 3-1 shows vehicle and payload processing facilities and some of their major features.

Table 3-2 lists some of the capabilities and characteristics of launchers on Wallops Island. Launcher capacities are determined by a variety of factors including total vehicle weight and the relative distribution of that weight at launcher interface points. Capacities listed in Table 3-2 indicate the maximum design loads under ideal circumstances. The launch pads and blockhouses are typically connected by various combinations of multipair 12 gauge and/or 16 gauge shielded and twisted pair cables and fiber optic cables. User provided launch systems can be accommodated. WFF also has the capability of supporting launch operations worldwide with mobile range instrumentation and equipment. See paragraph 3.2.20.

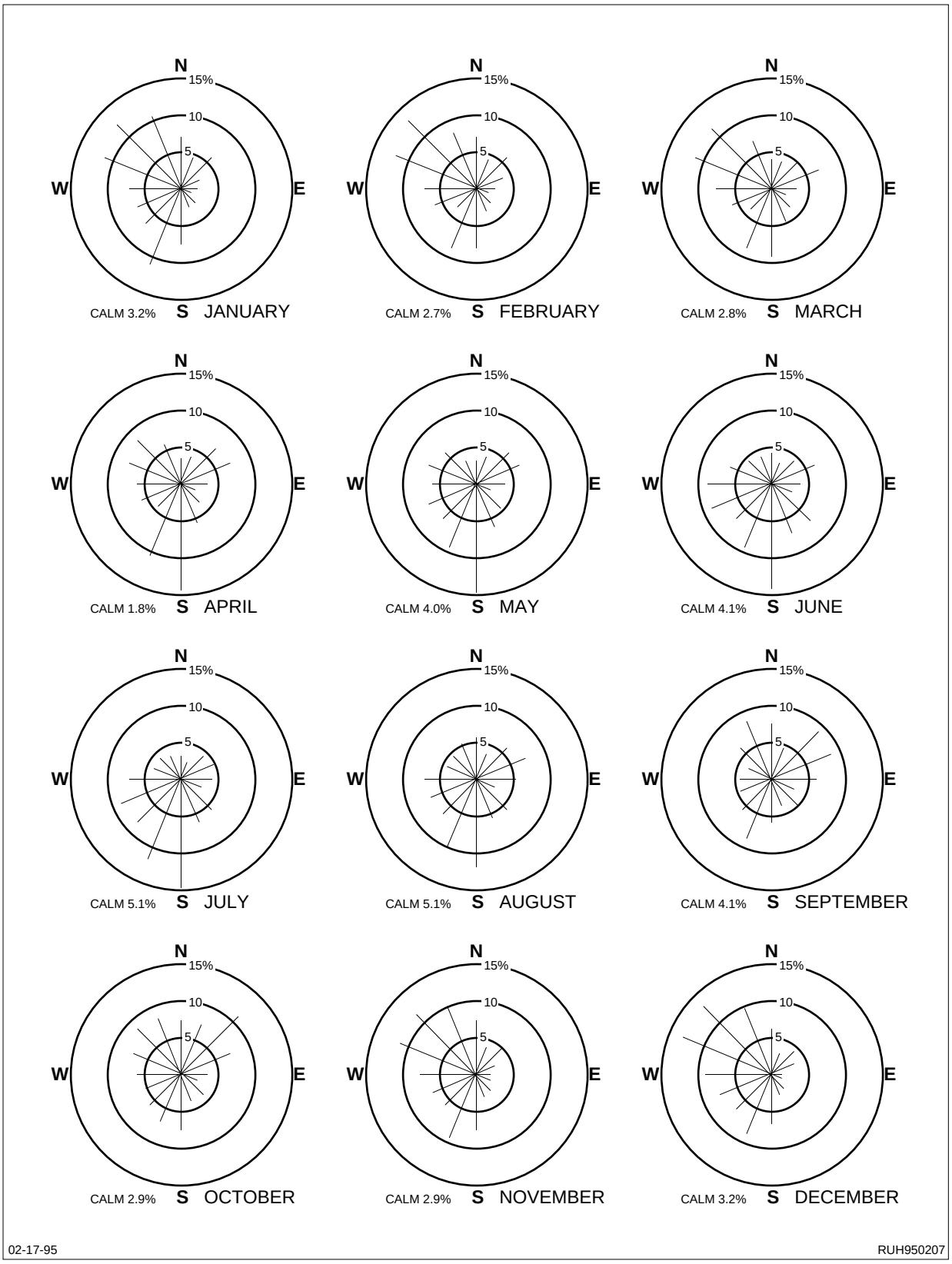

Figure 3-9. Wind Roses for Wallops Flight Facility by Month, all speeds inclusive

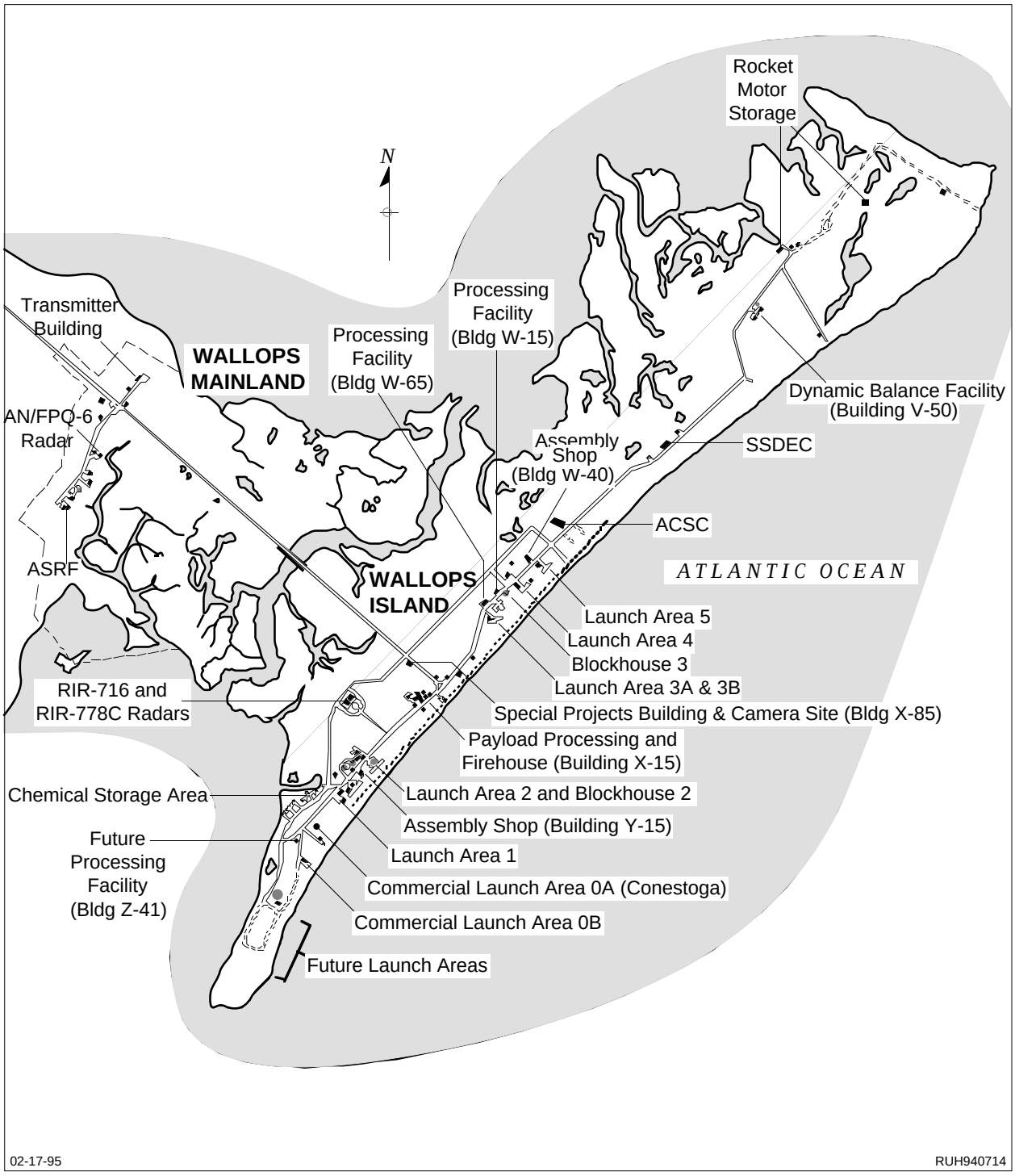

Figure 3-10. Wallops Mainland and Island Test Range Launch Facilities

Table 3-1.
Assembly and Payload Processing Facilities

Wallops Island

Building	Function	sq/ft	Special Features
W-15	assembly	5,165	• one 3,936 sq/ft bay • door 13 ft high x 12 ft wide • 3 ton overhead crane with 10 ft hook height (hh) • approved for explosives
W-40	assembly	5,255	• Currently supports Vandal Program
W-65	assembly	13,255	• 6 bays •• 5 assembly bays •• 1 clean room in Bay 6 20 ft x 20 ft x 8 feet door 95 in high x 94 in wide • pyrotechnic storage rooms • approved for explosives Bay 1: Doors HxW 17 ft 10 in x 23 ft 11 in; Crane(s) hook height (hh) 2x10 ton bridge/20 ft hh Bay 2: Doors HxW 18 ft x 23 ft 11 in, 17 ft 10 in x 23 ft 11 in; Crane(s) hook height (hh) 2x7.5 ton monorail/18 ft hh Bay 3: Doors HxW 17 ft 10 in x 18 ft 11 in; Crane(s) hook height (hh) 2x3 ton monorail/19 ft hh Bay 4: Doors HxW 14 ft 11 in x 15 ft 11 in; Crane(s) hook height (hh) none Bay 5: Doors HxW 14 ft 11 in x 15 ft 1 in; Crane(s) hook height (hh) 2x3 ton monorail/16 ft 5 in hh Bay 6: Doors HxW 14 ft 11 in x 23 ft 11 in, 14 ft 11 in x 23 ft 11 in; Crane(s) hook height (hh) 2x3 ton monorail/16 ft hh
X-15	payload processing	5,740	• co-located optical and crash/fire/rescue facilities • door 19 ft 10 in high and 18 ft 10 in wide • 3 ton overhead crane with 19 ft hook height • laboratory and office space
Y-15	assembly	8,240	• one high bay (Bay 8) • seven other bays • approved for explosives Bay 1: Doors HxW 9 ft 6 in x 17 ft 6 in Bay 2: Doors HxW 6 ft 10 in x 8 ft Bay 3: Doors HxW 6 ft 10 in x 8 ft Bay 4: Doors HxW 6 ft 10 in x 8 ft; Crane(s) hook height (hh) 3 ton monorail/7 ft 10 in hh Bay 5: Doors HxW 6 ft 10 in x 8 ft Bay 6: Doors HxW 6 ft 10 in x 8 ft; Crane(s) hook height (hh) 3 ton monorail/7 ft 10 in hh Bay 7: Doors HxW 6 ft 10 in x 8 ft Bay 8: Doors HxW 13 ft 7 in x 10 ft 10 in; Crane(s) hook height (hh) 2 ton bridge/15 ft 10 in hh

Wallops Main Base

Building	Function	sq/ft	Special Features
M-16	payload processing	19,290	• two bays 38 ft deep x 35 ft wide x 14 ft high • both are Class 100,000 clean rooms •• each has Class 10,000 clean tent 23 ft x 19 ft x 12 ft high • door 12 ft high and 25 ft wide
M-20	assembly	11,585	• single bay • end door 15 ft high and 25 ft wide • side door 13 ft high and 25 ft wide • approved for explosives

Table 3-2.
Launch Systems

Pad Number Launcher Name	Description
Pad 0A **Commercial**	Figure 3-11 shows the multilevel Conestoga launch complex for a commercial ELV.
Pad 1 **50K Launcher**	Rated as a 50,000 pound maximum design load launcher. Movable environmental shelter. 45 foot 6 inch overall boom length. Figure 3-12 shows the 50K launcher with a base ring for the ARIES sounding rocket mounted under the rail.
Pad 2 **Atlantic Research Corporation (ARC) Launcher**	Rated as a 20,000 pound maximum design load launcher Movable environmental shelter. 38 foot overall boom length. Figure 3-13 shows the ARC launcher.
Pad 2 **South** **Astro Met Launcher (AML)**	Rated as a 4,000 pound maximum design load launcher. Twin boom to accommodate single and multi-stage vehicles. 18 foot 8 inch overall boom length. Figure 3-14, shows the AML twin boom launcher with a rail mounted for the single stage ozonesonde rocket.
Pad 2 **North** **Astro Met Launcher (AML)**	Rated as a 4,000 pound maximum design load launcher. Twin boom to accommodate single and multi-stage vehicles. 18 foot 8 inch overall boom length. Figure 3-15, shows the AML twin boom launcher with two rails for a Superloki rocket mounted on the left boom.
Pad 2 **Improved High Altitude Diagnostic (HAD) Launcher**	Rated as a 7,500 pound maximum design load launcher. 31 foot overall boom length. Figure 3-16 shows the HAD launcher.
Pad 3A **Scout MK II launcher**	Scout class launcher with environmental shelter.
Pad 3B **20K Launcher**	Rated as a 20,000 pound maximum design load launcher. Movable environmental shelter. 37 foot overall boom length. Figure 3-17 shows the 20K launcher with the rail mounted environmental shelter pulled away. A launcher ring for the ARIES sounding rocket is mounted on the launcher.
Pad 4 **Tubular Launcher**	Rated as a 20,000 pound maximum design load launcher. 40 foot overall boom length. Figure 3-18 shows the tubular launcher on PAD 4.
Pad 5	Currently supporting United States Navy VANDAL Program. Figure 3-19 shows the Vandal launcher with two Vandal missiles.

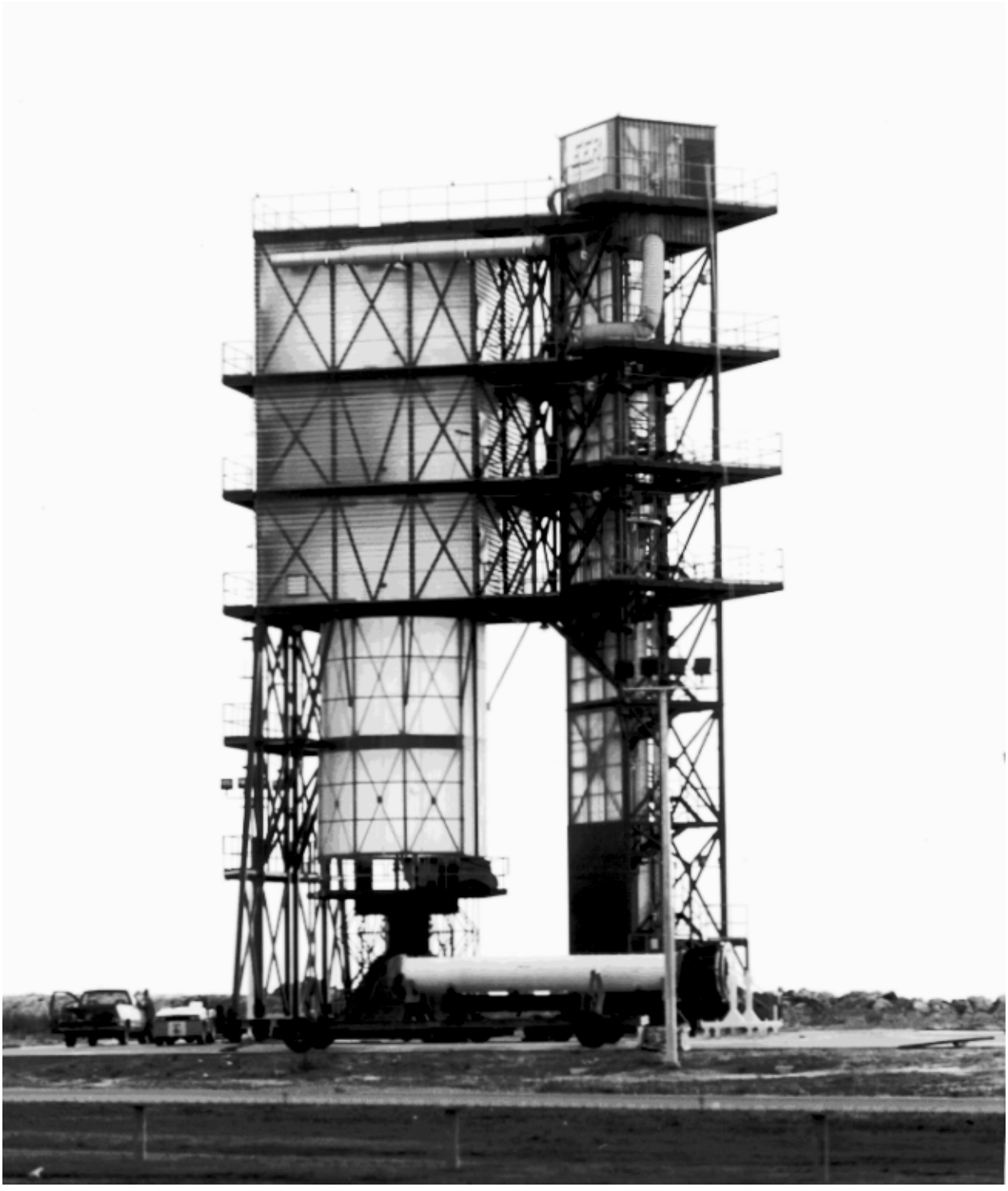

Figure 3-11. Multilevel Conestoga Launch Complex for a Commercial ELV on Pad 0A

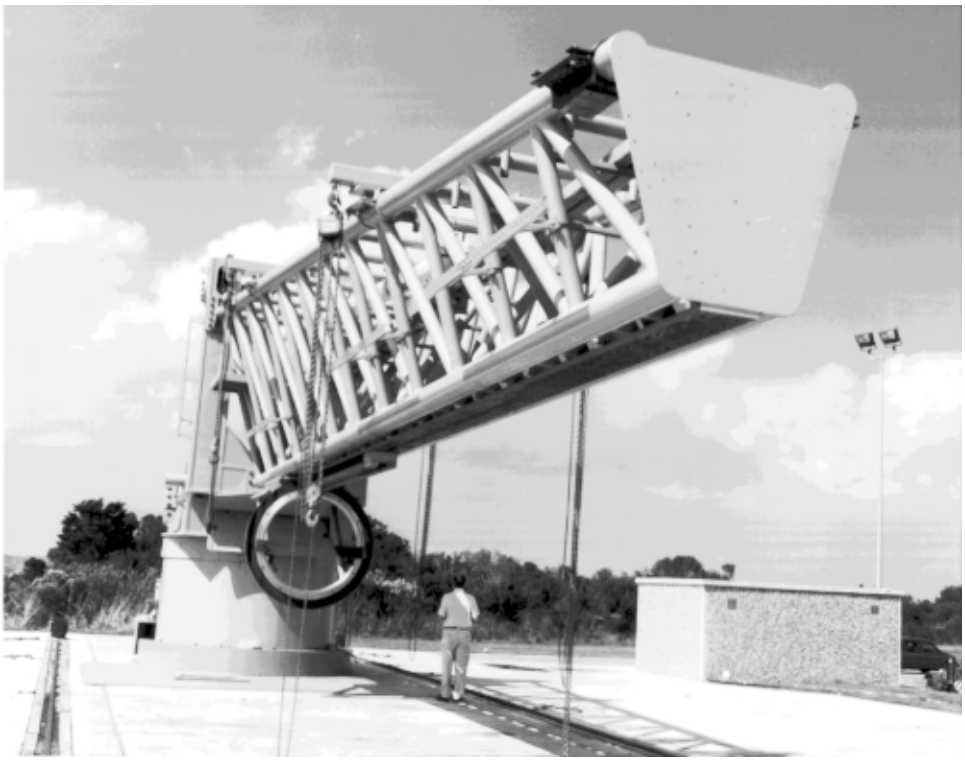

Figure 3-12. 50K Launcher on Pad 1

Figure 3-13. ARC Launcher on Pad 2

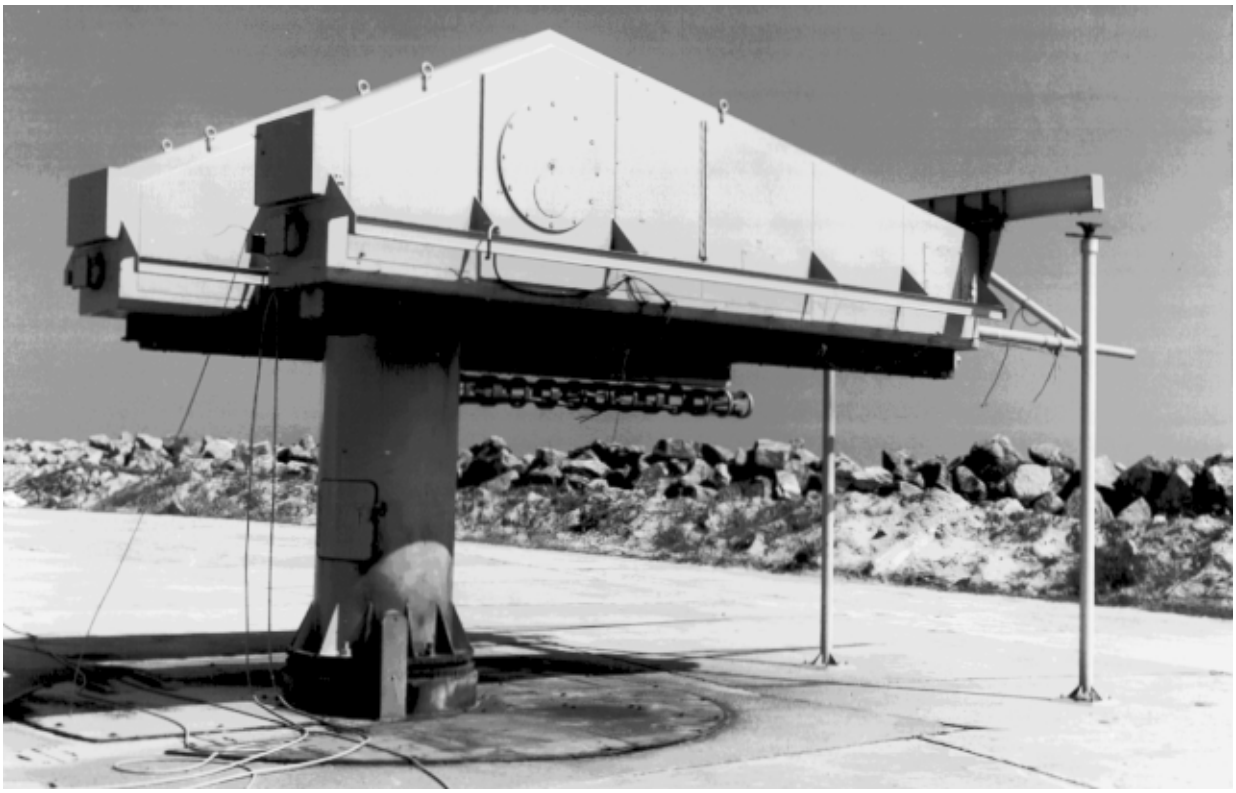

Figure 3-14. Pad 2 South AML Launcher

Figure 3-15. Pad 2 North AML Launcher

Figure 3-16. HAD Launcher at Pad 2

Figure 3-17. 20K Launcher on Pad 3B

Figure 3-18. Tubular Launcher on Pad 4

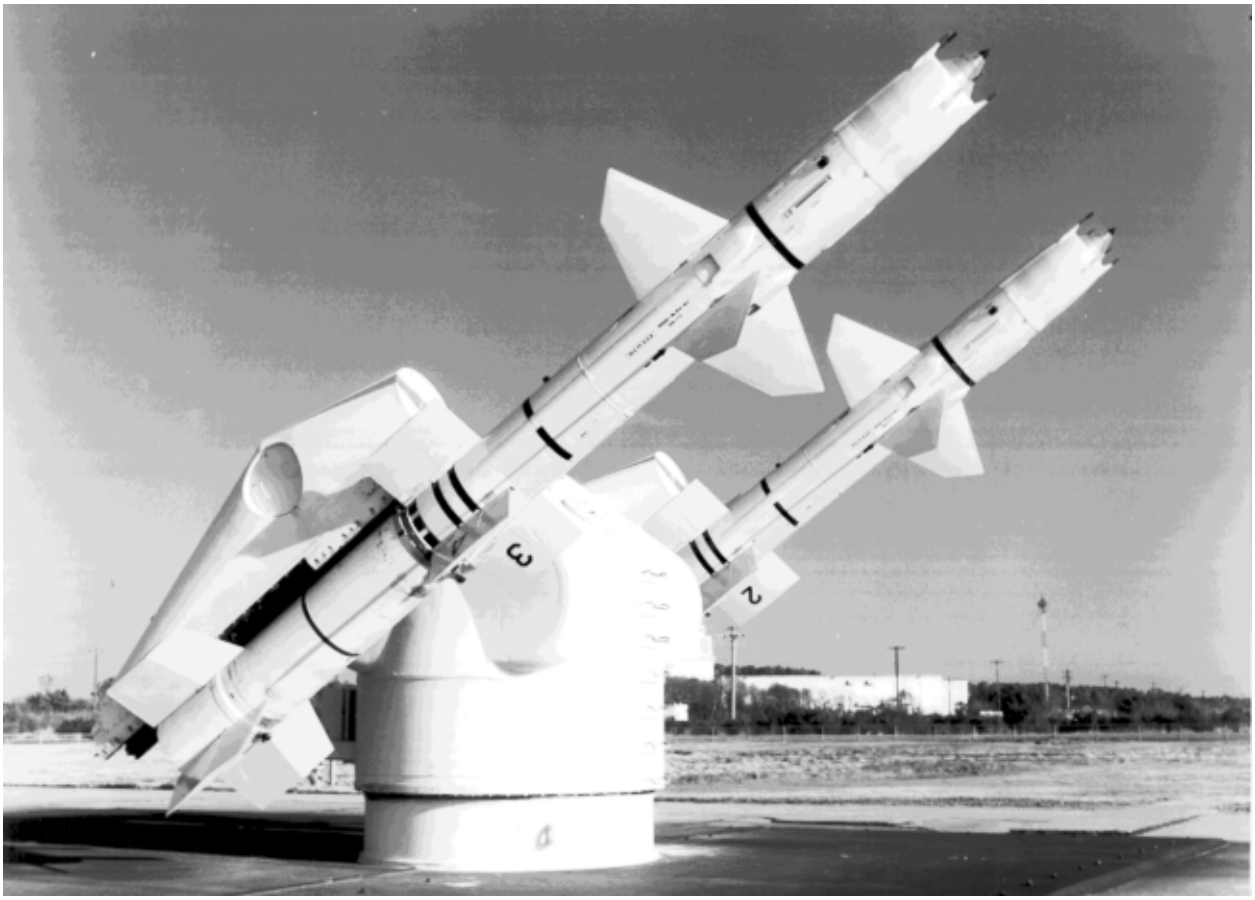

Figure 3-19. Vandal Launcher on Pad 5 with Two Vandal Missiles

3.2.2 Telemetry Facilities

Telemetry facilities at the Test Range include a variety of antennas, receivers, and display instrumentation systems. Command uplink and metric tracking capabilities are also available.

Post flight telemetry data can be distributed via magnetic tape, CD ROM and magneto-optical disks.

Detailed descriptions of systems and capabilities are available in the *Telemetry Facilities and Systems*, Volume II, Instrumentation Engineering Branch (IEB) Handbook, and the WFF *Tracking and Data Acquisition Systems Capabilities.*

3.2.2.1 Fixed Telemetry Systems

Telemetry systems consist of fixed range telemetry facilities and Wallops Orbital Tracking Station (WOTS) co-located in building N-162 on Wallops Main Base. Figure 3-20 is a view of the fixed telemetry facilities including WOTS.

The WOTS primarily supports low earth orbit spacecraft. However, WOTS facilities are flexible and can be used for range telemetry and share resources with the range telemetry systems. WOTS has metric tracking and command uplink. WOTS is undergoing a major automation upgrade, and the 6m and 9m parabolic antennas are scheduled to be replaced by 1997.

The technical characteristics of fixed telemetry systems are listed in the following tables.

- Table 3-3 Range Telemetry Systems
- Table 3-4 Wallops Orbital Tracking Station (WOTS)

3.2.2.2 Transportable Telemetry Facilities

WFF has transportable telemetry capabilities for use at other locations. Transportable telemetry systems have metric tracking (Doppler and angles) and command uplink.

The technical characteristics of transportable telemetry systems are listed in following tables.

- Table 3-5 Transportable Telemetry Systems Summary
- Table 3-6 Transportable Van Summary
- Table 3-7 TRADAT V Telemetry System
- Table 3-8 Transportable Orbital Tracking Station (TOTS) Systems

The Transportable Orbital Tracking Station (TOTS) was developed to provide a multimission transportable low earth orbit spacecraft tracking capability. TOTS can also support vehicle and payload telemetry. The TOTS is S-band and can be upgraded to X-band. There are three TOTS. By 1997 , a refurbished 9M fixed Redstone antenna will replace one of the two TOTS installations at PFRR to support sounding rocket launches. Figure 3-21 is a TOTS installation at PFRR.

Figure 3-20. Range Telemetry Facility and Wallops Orbital Tracking Station (WOTS)

Figure 3-21. Transportable Orbital Tracking Station (TOTS)

Table 3-3. Range Telemetry Systems

Receiving Characteristics

Antenna Diameter/Type	Frequency Range	Polarization	G/T (Minimum)	Noise Temp. @ Degrees K	Receiver Type	Gain	Tracking Modes	Pedestal Type
LGTAS 2.4M/8ft 2 Parabolic Note 1	1435-1540 MHz 1650-1710 MHz 2200-2300 MHz	RHC/LHC	5.18 dB/K @ 2.25 GHz	400 @ S-Band	Microdyne 1100-AR	L-Band: 28 dB 1680 Band: 29 dB S-Band: 32 dB	Autotrack Slave Manual Computer	EL/AZ
MGTAS 7.3M/24ft 2 Parabolic/ Note 2	1400-2400 MHz	RHC/LHC	16 dB/K @ 2.2 - 2.4 GHz 13 dB/K @ 1.4 - 2.2 GHz	200 @ 1.4-2.1 GHz 250 @ 2.2-2.3 GHz	MFR S/A 410 DEI 74 Microdyne 1100-AR	39 dB @ 2250 MHz	Autotrack Slave Manual Programmed	EL/AZ

G/T - Gain/System Noise Temperature or Figure of Merit.

Notes:
1. The LGTAS (Low Gain Telemetry Antenna System) antennas reside atop building N-162.
2. MGTAS (Medium Gain Telemetry Antenna System) is located in antenna field near building N-162. The MGTAS antennas are listed here with range telemetry systems and on Table 3-4, Wallops Orbital Tracking Station.
3. The WOTS 18M antenna system *can* be used for Test Range support.

Table 3-4. Wallops Orbital Tracking Station

Receiving Characteristics

Antenna Diameter/Type	Frequency Range	Polarizations	G/T (Minimum)	Receiver Type	Up/Down Con. Freq.	Tracking Modes	Pedestal Type
18M/60ft Parabolic	1.4.-2.4 GHz	LHC & RHC div	28.5 dB/K @ 2.2-2.4 GHz 28 dB/K @ 1.4-2.4 GHz	MFR	400-500 MHz P- Band	Manual, auto, STAR, and STPS (future)	EL/AZ
11M/36 ft Parabolic	2200-2400 MHz 8000-9000 MHz	S-band: any X-band: RHC or LHC or axial ratio	22.8-23.6 dB/K @ 2.2-2.4 GHz 35.0-35.5dB/K@ 8.0-8.5 GHz	SA 930	214-315 MHz S-band 375 MHz X-band	Auto, manual	EL/AZ w/rotatable train axis
9M/30ft Parabolic	2.2-2.3 GHz	RHC & LHC div	23 dB/K@ 2250 MHz	MFR	400-500 MHz	Auto, slave, TDPS, manual, and STPS (future)	X-Y
7.3M/24ft (STDN) 2 Parabolic Note 1	1.4-2.3 GHz	H/V or LHC & RHC div	16 dB/K@ 2.2-2.4 GHz, 13 dB/K @ 1.4-2.2 GHz,	MFR, S/A 410 DEI 74, 1100-AR	400-500 MHz P-Band	Auto, slave, manual, programmed	EL/AZ
Array 1 SATAN	136-138 MHz	Linear Diversity	-8 dB/K @ 137 MHz	MFR	400-500 MHz	Manual, slave	X-Y
Array 2 SATAN	136-138 MHz	Linear Diversity	-8 dB/K @ 137 MHz	MFR	400-500 MHz	Manual, slave	X-Y
7.3M/24ft METEOSAT Parabolic (dedicated)	1690-1700 MHz	Linear Diversity	19.6 dB/K @ 1690 MHz	1100-AR	400-500 MHz	Manual	EL/AZ Kingpost
7.3M/24ft UHF (MET-3/ TOMS) Parabolic	464–469 MHz	RHC & LHC div	4.0 dB/K @ 466 MHz	MFR	none	Manual, slave	X-Y

Note: 1. Also listed as MGTAS antennas on Table 3-3, Range Telemetry Systems.

Transmitting Characteristics

Antenna Diameter/Type	Frequency Range	Polarizations	Transmitter Type	Power	EIRP	Tracking Modes	Pedestal Type
9M/30ft Parabolic	2025-2120 MHz	RHC/LHC	TWTA/exciter Solid State Amp	200 W/16 W	96 dBmi	Auto, slave TDPS, manual, and STPS (future)	X-Y
11M/36 ft Parabolic	2025-2120 MHz	RHC or LHC S-band	Solid State Class “C”	200 W	96 dBmi @2025 MHz	Auto, manual	EL/AZ w/rotatable train axis
6M/20ft Command Parabolic	2025-2120 MHz	RHC/LHC	TWTA/exciter Solid State Amp	200 W/16 W	92 dBmi	Manual, slave	X-Y
Array SATAN	147-152 MHz	RHC/LHC Linear	Linear	10 KW	92 dBmi	Manual, slave	X-Y
Array SCAMP	147-152 MHz	RHC/LHC Linear	Linear	10 KW	87 dBmi	Manual, slave	X-Y

Table 3-5. Transportable Telemetry Systems Summary

Antenna Diameter/Type	Frequency Range	G/T (Minimum)	Tracking Modes	Pedestal Type	Trailer	Van	Remarks
Antenna #1 3 M/10ft 4 Section Parabolic	1435–1540 MHz 1650–1710 MHz 2200–2300 MHz	7.1 dB/K @ 2.25 GHz	Autotrack Slave Manual	EL/AZ	8.5M/28ft Lowboy	Van #1 (RV) or Van #2	Shipping container available
Antenna #2 3 M/10ft Solid Parabolic	1435–1540 MHz 1650–1710 MHz 2200–2300 MHz	7.1 dB/K @ 2.25 GHz	Autotrack Slave Manual	EL/AZ	8.5M/28ft Lowboy	Van #1 (RV) or Van #2	Shipping container available
Antenna #3 2.4M/8ft Solid Parabolic	1435–1540 MHz 2200–2300 MHz	5.18 dB/K @ 2.25 GHz	Autotrack Slave Manual	EL/AZ	5.5M/18ft Lowboy	Van #1 (RV) or Van #2	Shipping container available
Antenna #4 2.4M/8ft Solid Parabolic	1435–1540 MHz 2220–2300 MHz	5.18 dB/K @ 2.25 GHz	Autotrack Slave Manual	EL/AZ	5.5M/18ft Lowboy	Van #1 (RV) or Van #2	Shipping container available
Antenna #5 2.4M/8ft Parabolic Reflector	1435-2300 MHz (includes 1680)	5.18 dB/K @ 2.25 GHz	Autotrack Slave Manual	EL/AZ	n/a	n/a	Installed at Poker Flat Research Range
Antenna #6 4.8M/16ft Parabolic Reflector	1435-2300 MHz (includes 1680)	11.0 dB/K @ 2.25 GHz	Autotrack Slave Manual	EL/AZ	n/a	n/a	Installed at Poker Flat Research Range
Antenna #7 2.1M/6ft "Minitracker" 2 Section Parabolic	2200–2300 MHz	2.9 dB/K @ 2.25 GHz	Autotrack Slave Manual	EL/AZ	n/a; compact pedestal	n/a	Minitracker TM Systems Total Weight 1000 lbs.
Antenna #8 2.1M/6ft "Minitracker" 2 Section Parabolic	2200–2300 MHz	2.9 dB/K @ 2.25 GHz	Autotrack Slave Manual	EL/AZ	n/a; compact pedestal	n/a	Minitracker TM Systems Total Weight 1000 lbs.
Antenna #9 6.1M/20ft 8 Section Mesh Parabolic	1435–1540 MHz 2200–2300 MHz	17.2 dB/K @ 2.25 GHz	Autotrack Slave Manual	EL/AZ	12.8M /42ft Flatbed w/ enclosed shelter	#4	Antenna #9 can be shipped in a C-141 aircraft.
Antenna #10 5.5M/18ft 16 Section Mesh Parabolic	1435–1540 MHz 2200–2300 MHz	14.5 dB/K @ 2.25 GHz	Autotrack Slave Manual	EL/AZ	n/a	Self-equipped container	Antenna #10 is configured for shipborne transport.

Table 3-6. Transportable Van Summary

Van	Size	Function
#1	7.9m (26 ft)	• This is a self-propelled recreational research vehicle equipped to support various balloon programs. It is a modified GMC Transmode Van; gross wt of 4540 kg (10,000 lbs). • Interfaces with Scientific Atlanta 2.4m (8 ft) & 3m (10 ft) tracking antennas.
#2	12.2m (40 ft)	Expandable instrumentation van (trailer) that features automatically regulated air suspension system for leveling and shock protection. Antenna controls for 2.4m (8 ft) & 3m (10 ft) dishes can be installed in this trailer.
#3	12.2m (40 ft)	Standard 40 ft trailer used on various mobile campaigns with similar capabilities as Van #2.
Super Van	14.8m (48 ft)	Multipurpose telemetry van. Equipped to support 2.4m (8 ft), 3m (10 ft), or 5.5m (18 ft) antenna systems individually and simultaneously.
20' Tracker	12.2m (40 ft)	40 ft flat bed trailer with hydraulic erected 6.2m (20 ft) tracker and 20 ft long instrumentation shelter.
Self-equipped	3m (10 ft)	Supports Mini-tracker system
Pad mounted	Various	Equipped to support pad mounted 8m (26 ft) TM antenna.
C-130 container for air, sea, land transport	12.2m (40 ft)	Mobile Range Control System with redundant command transmitters for command and flight termination, UPS, Range Safety Display System, real time computer processors, communications.

Table 3-7. TRADAT V Telemetry System

Antenna Type	Frequency	Remarks
Tradat V Trajectory Data System. One single 10-turn helix antenna for command.	FM/FM	• PCM ranging system provides trajectory data for vehicles such as sounding rockets or balloons. • The command antenna is normally attached to the telemetry antenna and interfaced with the host's autotrack controller system and transmits to an airborne PCM receiver/transmitter.

Table 3-8. Transportable Orbital Tracking Station (TOTS) Systems

Antenna #11, Antenna #12, and Antenna #13

Receiving Characteristics

Antenna Diameter/Type	Frequency Range	Polarization	G/T (Minimum)	Receiver Type	Up/Down Con. Freq.	Tracking Modes	Pedestal Type
Transportable system 8 meter/26 foot Parabolic	2200-2400 MHz Upper L-Band	RHC & LHC Diversity Combined Pre/Post Detection	150 °K; 21 dB/°K G/T	S/A 930; Microdyne 1400; Microdyne 1100; MFR, DEI 7400	Raw; 215-315 MHz 400-500 MHz	Auto Manual Slave Computer	S/A 3315M; EL/AZ; 20°/ Sec AZ/EL Velocity; 20°/sec AZ/EL Acceleration

Transmitting Characteristics

Antenna Diameter/Type	Frequency Range	Polarization	Transmitter Type	EIRP	Tracking Modes	Pedestal Type
Helix 10 Turn	547, 550, 553 MHz	RHC	Various Types	200W RMS for 63 dBmi	Auto Manual Slave Computer	S/A 3315M; EL/AZ: 20°/ Sec AZ/EL Velocity; 20°/Sec AZ/EL Acceleration
Transportable system 8 meter/26 foot Parabolic	2025-2120 MHz	RHC or LHC	AYDIN Solid State	200W RMS for 93 dBm EIRP @ 2025 MHz	Auto Manual Slave Computer	S/A 3315M; EL/AZ: 20°/ Sec AZ/EL Velocity; 20°/Sec AZ/EL Acceleration

Notes:
1. TOTS requires pre-positioned concrete pad for precision angular accuracy.
2. Housed in a 40-foot expanding-side ISO container.
3. Set-up time is estimated to be 3 days after arrival on site.

3.2.3 Radar System Facilities

Radar systems perform tracking and surveillance functions. Table 3-9 lists the significant characteristics of tracking radar systems and ground based and airborne surveillance radar systems.

3.2.3.1 Tracking Radar Systems

Tracking radar systems provide accurate velocity and positional data of launch vehicles, balloons, satellites, and aircraft. The Range has four fixed (permanently installed) and four mobile (transportable) tracking radar systems. The fixed radar systems are: the Research Airport's RIR-716C, the Mainland's AN/FPQ-6, and the Island's RIR-716C and AN/MPS-19. The Airport RIR-716C also has a Laser Tracking System (LTS) to perform automatic, short range, high precision tracking. Figure 3-22 is the AN/FPQ-6 Radar System on the Mainland.

Figure 3-22. AN/FPQ-6 Radar System on the Mainland

3.2.3.2 Surveillance Radars

Surveillance radars provide range surveillance to detect water surface and airborne targets. There are two fixed surveillance radar systems to support operations on the Range: the AN/ASR-7 at the Research Airport and the Marine Pathfinder radar system on Wallops Island. Two airborne surveillance radar systems can be installed on WFF aircraft: the AN/APS-80B(V) and the AN/APS-128E.

Additional information regarding Range radars is found in the Instrumentation Engineering Branch (IEB) Handbook, Volume I, *Radar Facilities and Systems* and the *GSFC/WFF Tracking and Data Acquisition Systems Capabilities* document.

Table 3-9. Synopsis - Wallops Flight Facility and Airborne Radar Systems

WFF ID No.	Radar	Wave Length Band	Peak Power Output (Watts)	Pulse Rate Frequency (pps)	Beam-width (deg.)	Antenna Size (Meters)	Antenna Gain (dB)	Max-Range (KM)	1-m^2 Skin Track (KM)	Range Precision (Meters) (rms)	Angle Precision (mils rms)	Tracking Velocity (deg/sec) AZ	EL
UHF	ASRF	UHF	8 M	320-960	2.9	18.29	36	n/a	1480	n/a	2.0	8	8
4	ASRF (SPANDAR)	S	5 M	160, 320, 640, 960	0.39	18.29	52.8	480 K	2200	5	1.0	15	15
6	AN/MPS-19	S	325 K	160, 320, 640, 1280	3.0	2.44	33	925	100	10 KMS	1.0	60	60
n/a	AN/ASR-7	S	425 K	713, 1200, others available	1.5 (AZ) csc^2 (EL)	5.33 x 2.74	34	110	75 (Aircraft)	1%	n/a	n/a	
5	AN/FPQ-6	C	3 M	160, 640, others available	0.39	8.84	51	60 K	1300	3	0.05	20	20
3	RIR-716 (Island)	C	1 M	160, 640	1.23	3.66	43	60 K	350	3	0.15	45	28
18	RIR-716 Airport Radar	C	1 M	160, 320, 640, 1024	0.71	4.88	46	60 K	435	3	0.1	31	28
	Airport Laser	Infrared	125	40	0.11	0.18	n/a	40	n/a	0.5	0.1	n/a	
2	RIR-778C (mobile)	C	1 M	160, 320, 640	3.0	2.44	38	3745	220	5	0.24	34	34
8	RIR-778C (mobile)	C	1 M	160, 320, 640	3.0	2.44	38	3745	220	5	0.24	34	34
9	RIR-778C (mobile)	C	1 M	160, 320, 640	3.0	2.44	38	3745	220	5	0.24	34	34
10	RIR-778C (transportable)	C	1 M	160, 320, 640	1.1	3.66	43	60 K	425	3	0.15	34	34
11	RIR-778C (transportable)	C	1 M	160, 320, 640	1.1	3.66	43	60 K	425	3	0.15	34	34
n/a	Mariner's #2 Pathfinder	X	20 K	900, 1800, 3600	0.9@ 3 dB(H)	3.67 x 0.15	32	125	n/a	n/a	n/a	n/a	
n/a	AN/APS-80B (V)	X	200 K	200	2.4(H)	1.18x 0.81	35	155	n/a	n/a	n/a	n/a	
n/a	AN/APS-128E (airborne)	X	100 K	267, 400 1200, 1600	2.4 (H) 9.0 (V)	1.06x 0.305	31	125	n/a	1% max. range	n/a	n/a	

3.2.4 Command, Control, and Communications Facilities

The communications systems at the Test Range are composed of:

- HF/VHF/UHF radios
- microwave links
- teletype systems
- Local Area Networks
- telephone
- Internet
- frequency shift tone keying
- NASA Communication's (NASCOM 2000) Network Terminal
- cable plant
- high-speed data circuits
- data transmission systems
- 12 channel intercom
- 40 channel intercom in RCC
- electronic mail
- Administrative Message Service (AMS)
- closed-circuit television systems

The cable plant supporting communications systems include extensive telephone, coaxial cable, and fiber optic cables interconnecting WFF facilities. Fiber optic cables connect the Main Base, Mainland, and Wallops Island areas.

The frequency shift tone keying system provides remote control of events and devices such as cameras and recorders.

The communications systems emphasize flexibility to configure to User requirements. These systems provide the means for managing operations at the Range and communicating and coordinating with related operations in other geographic areas. For additional information, see IEB Handbook, Volume IV, *Communications Facilities and Systems*.

3.2.5 Data Systems

Data is acquired during mission operations from radar, telemetry, optical, meteorological, and timing systems. A variety of data systems acquire, record, and display information in real time for science, control, and monitoring flight performance. WFF has the capability to provide data in processed parameters and formats specified by the User. Data can be recorded on disk and magnetic tape in various formats. Optically derived data is available on video tape and film. Video tapes of real time displays in the RCC can be provided.

Tracking data can be transmitted to remote locations in two formats: Minimum Delay Data Format (MDDF) and Launch Trajectory Acquisition System (LTAS) format. MDDF data is a raw radar data (range az/el versus time of day relative to radar pedestal). LTAS data is smooth radar data relative to the center of the earth.

Inertial Navigation System (INS) and Global Positioning System (GPS) on board flight system data can be received at WFF by telemetry and can be converted to LTAS format.

For additional information, see IEB Handbook, Volume III, *Data Systems and Facilities.*

3.2.6 Command Systems

UHF command systems provide control of airborne vehicle (rocket, balloon, or aircraft) functions for on board experimental devices. The systems also provide flight termination capabilities for range safety purposes. There are fixed and mobile system capabilities. Omni, single helix, and quad helix antennas are used, and antennas are selected based on mission requirements. Table 3-10 shows characteristics of the command transmitters and antennas available. Command systems feature fail-over redundant transmitters and antennas. A typical configuration has 20 IRIG tones available for modulation.

The fixed command system at the Range can be controlled by the Range Safety Officer in the RCC or from building U-55 on Wallops Mainland. Control of the mobile system is from the 6m (20 ft) shelter housing the transmitters. An Instantaneous Impact Prediction/Command Destruct (IIP/CD) System is deployed with the Mobile Range Control Center. Additionally, the mobile systems and a command system in the Bermuda Islands can be controlled from the RCC.

The Digital Range Safety Set (DRSS) command system supports Space Transportation System (STS) missions. It does not use IRIG tones. The DRSS uses the two ALEPH transmitters and two Orbit quad-helix antennas listed in Table 3-10 and communications links with The USAF Eastern Range.

3.2.7 Frequency Monitoring

Communications are supported by frequency monitoring equipment and frequency spectrum allocation management and coordination capabilities. The Frequency Monitoring System is used to monitor the frequency spectrum and for the detection and locating the source of radio-frequency interference (RFI). The Range is capable of monitoring frequencies to 22 GHz.

3.2.8 Timing

The Master Timing Station (MTS) provides time synchronization and coordination of range activities. The system provides for the distribution of time codes, reference signals, and Program Time (countdown) information to all required locations. The Time-of-Year (T.O.Y.) system is synchronized to the Global Positioning System (GPS). A GPS time transfer unit is used to synchronize the MTS and the remote sites. The codes are received and amplified at the various remote User sites for a variety of functions including use with recorders, oscillographs, camera sites, and for driving remote timing displays. Program Time provides a visual count status and programmable function control for events. Synchronous generators and translators at sites provide for fail-safe operation, propagation delay correction, and translation of received time codes to other codes (e.g. IRIG-A), and reference signals.

The following time codes are available:

NASA 28-bit	IRIG-B
NASA 36-bit	IRIG-E
	IRIG-H

For additional information, see CSC/TM-73-4328, *NASA/GSFC/WFF Timing Synchronization Procedures Manual.*

Table 3-10.
Command Systems

Fixed Command System

Transmitters			Antennas		
Type	**Frequency**	**Power**	**Type/Control**	**Gain**	**Polarization**
(2) ALEPH CTS-100 1000 Watts	406-549 MHz FM IRIG Tones	• Commercial AC • Generator for redundant system	(2) Obit quad-helix; radar slaved or manual control	18 dB	LHC
			(2) Omni	0 dB	Vertical

Mobile Command Systems

Transmitters			Antennas		
Type	**Frequency**	**Power**	**Type/Control**	**Gain**	**Polarization**
(2) Henry Radio Company 1000 Watts	406-450 MHz	Built-in UPS	Antlab quad-helix, trailer mounted, radar slaved or manually controlled	18 dB	LHC
			(2) Automatically controlled single-helix	15.3 dB	LHC
			(2) Omni	0 dB	LHC
IIP/CD (2) PSC Solid State	400-450 MHz	2 UPS	(2) Automatically controlled single-helix	15.3 dB	LHC

3.2.9 Research Airport

The WFF Research Airport is located on the Main Base 5 miles west of the town of Chincoteague on the Eastern Shore of Virginia, at geographical coordinate 37 degrees 57 minutes north latitude, and 75 degrees 28 minutes west longitude. Field elevation is 41 feet above sea level. Figure 3-1 is an aerial view of the Wallops Main Base including the Research Airport. Figure 3-23 shows the Research Airport and associated facilities

There are three runways, two taxiways, three ramps, and one hazardous cargo loading area in active service. The runway dimensions are:

a. 04/22—8750 feet by 150 feet (primary research runway)

b. 10/28—8000 feet by 200 feet

c. 17/35—4820 feet by 150 feet

The taxiways that service these three runways are parallels of 04/22 and 10/28 and are virtually the same length as their respective runways. Two ramps adjoin the two active hangars, and a third ramp adjoins the Crash Fire and Rescue building. The hazardous cargo loading area adjoins the approach end of runway 17.

Runways 10 and 17 are configured with FAA approved circling and straight-in approaches.

Runway 04/22, the primary research runway, has a test section with a variety of surface textures and materials for runway research projects. It features:

- a grooved section
- a water test section with slots for sectional damming for water level control
- a runway-to-taxiway high speed turnoff
- FAA commissioned Microwave Landing System (MLS).
- E-28 arresting gear

3.2.9.1 Instrumentation and Facilities

To provide precision tracking for airborne research programs, a RIR-716C C-band radar (Radar 18) with an integrated Laser Tracking System (LTS) is located on the airport at the Aeronautical Research Radar Complex (building A-41). This radar can provide an aircraft with Instrument Landing System (ILS) reference data to any WGS84 point within 50 nm of the Research Airport. Precision Approach Path Indicators (PAPI) are installed on all runways. Control Tower support is available. Annotations on Figure 3-23 show the locations of facilities at the Research Airport. For more detailed descriptions, consult the GSFC/WFF *Airport Operations Manual.*

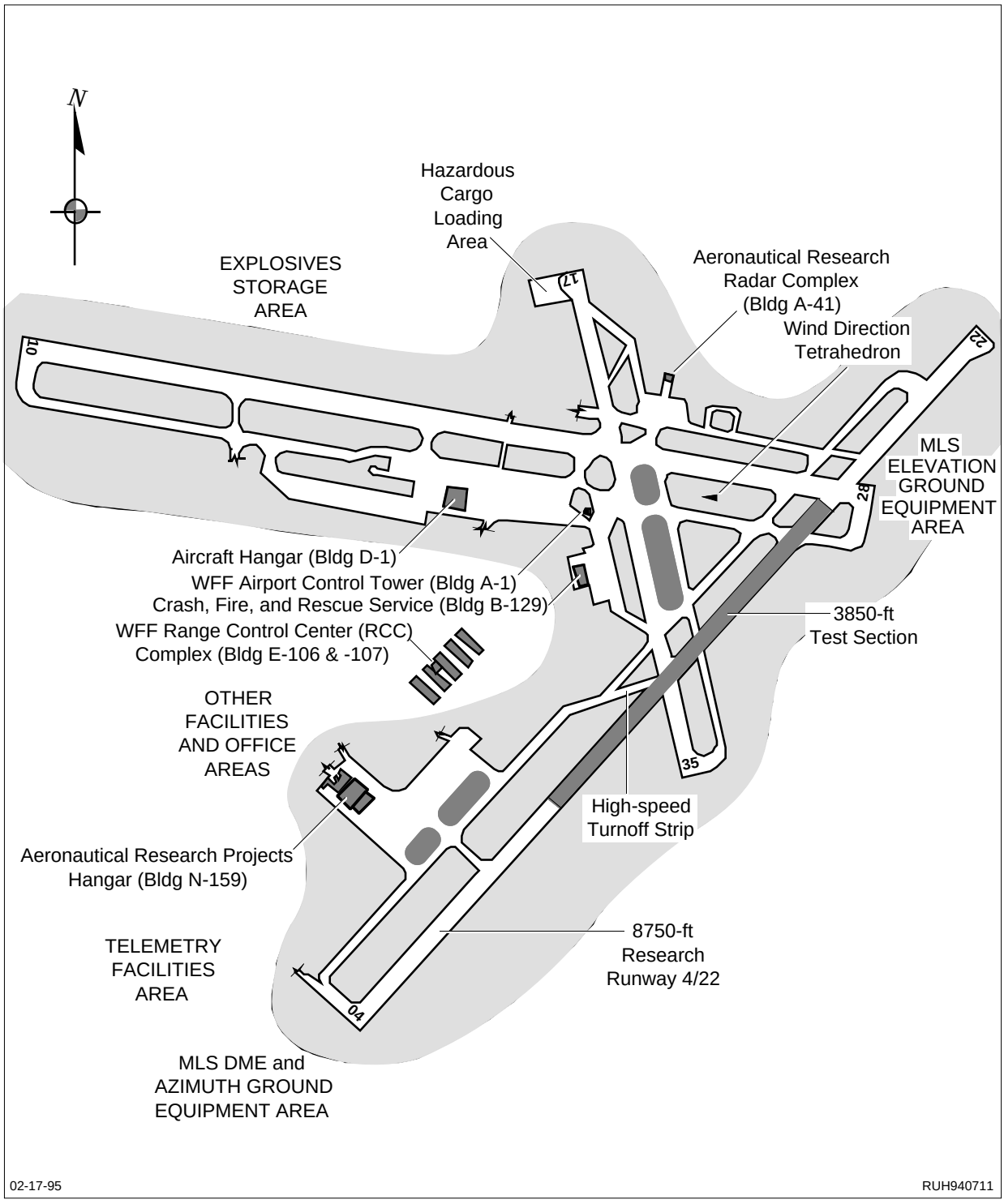

Figure 3-23. WFF Research Airport with Associated Facilities

3.2.9.2 Support and Services

The following is a list of aircraft support and services which can be provided at the Research Airport with prior arrangement. Additional information regarding Airport use is in the *GSFC/WFF Airport Operations Manual.*

- hangar space
- minor and temporary repairs
- fuel services for JP-5 and JPTS
- ground power units
- aircraft towing
- entrance stairs
- oxygen service, both liquid and gaseous
- local and national meteorological info
- flight planning support
- first aid and emergency treatment
- hazardous cargo handling
- hydrazine fuel handling
- night operations support
- support aircraft carrying combat ordnance

Hanger, office, and shop space are available for approved aircraft projects. The available shops and spaces vary in size and location, with most of them being provided in building N-159.

WFF is not equipped to effect other than minor or limited repairs to transient aircraft. Normally, project and R&D type aircraft should bring their own maintenance personnel when engaged in flight operations at WFF. However, limited assistance may be provided for minor repairs.

Fuel services are available for United States Government program aircraft during normal working hours and at other times by prior arrangement. Fuel is dispensed from trucks equipped with single point refueling fittings.

3.2.10 Range Control Center (RCC)

The focal point for all Test Range operations is the RCC located in building E-106 on the Main Base. Data from the range support instrumentation - for example, closed circuit television, radar and telemetry data - are acquired, processed and made available for video display throughout the facility. This data assimilation in conjunction with communications and command links facilitates the coordination, control, and safe conduct of WFF missions. The Range Data Acquisition & Computation (RADAC) System supports the RCC with redundant real-time data support, including impact prediction, for range safety and other test range requirements. The RADAC System provides a quick and flexible selection of data sources and displays. The video switching network is the primary means of distributing data in the RCC. All critical instrumentation is supported by UPS and a backup power generator.

The RCC is composed of co-located rooms devoted to range control functions. The rooms are:

- Mission Control Room (MCR)
- Data Acquisition & Processing Room
- Range Safety Room
- Secure Room
- Surveillance & Down Range Communications Room
- MCR Observation Area
- Aeronautical Projects Control Room
- Automatic Data Processing
- Instrumentation Room
- Weather Forecast Office

The WFF RCC *Guide to Range Control Center Communications*, provides information on the RCC communications, data systems, and other capabilities available to support a project at the Test Range.

The following paragraphs briefly identify the major parts of the RCC.

3.2.10.1 RCC Mission Control Room (MCR)

The two-story high MCR features large screen video displays, eight generic mission controller consoles, a raised Test Director area, and a VIP area. Figure 3-24 shows a view of the MCR from the Test Director's Console and Figure 3-25 is the layout of the MCR.

Figure 3-24**.** RCC Mission Control Room

Typically, Mission Controller Stations 1, 2, 3, 4, 6 and 8 are available to support Range User functions. Additional console space can be made available for some missions in adjacent Surveillance and Down Range Communications Room and/or the RCC Secure Room.

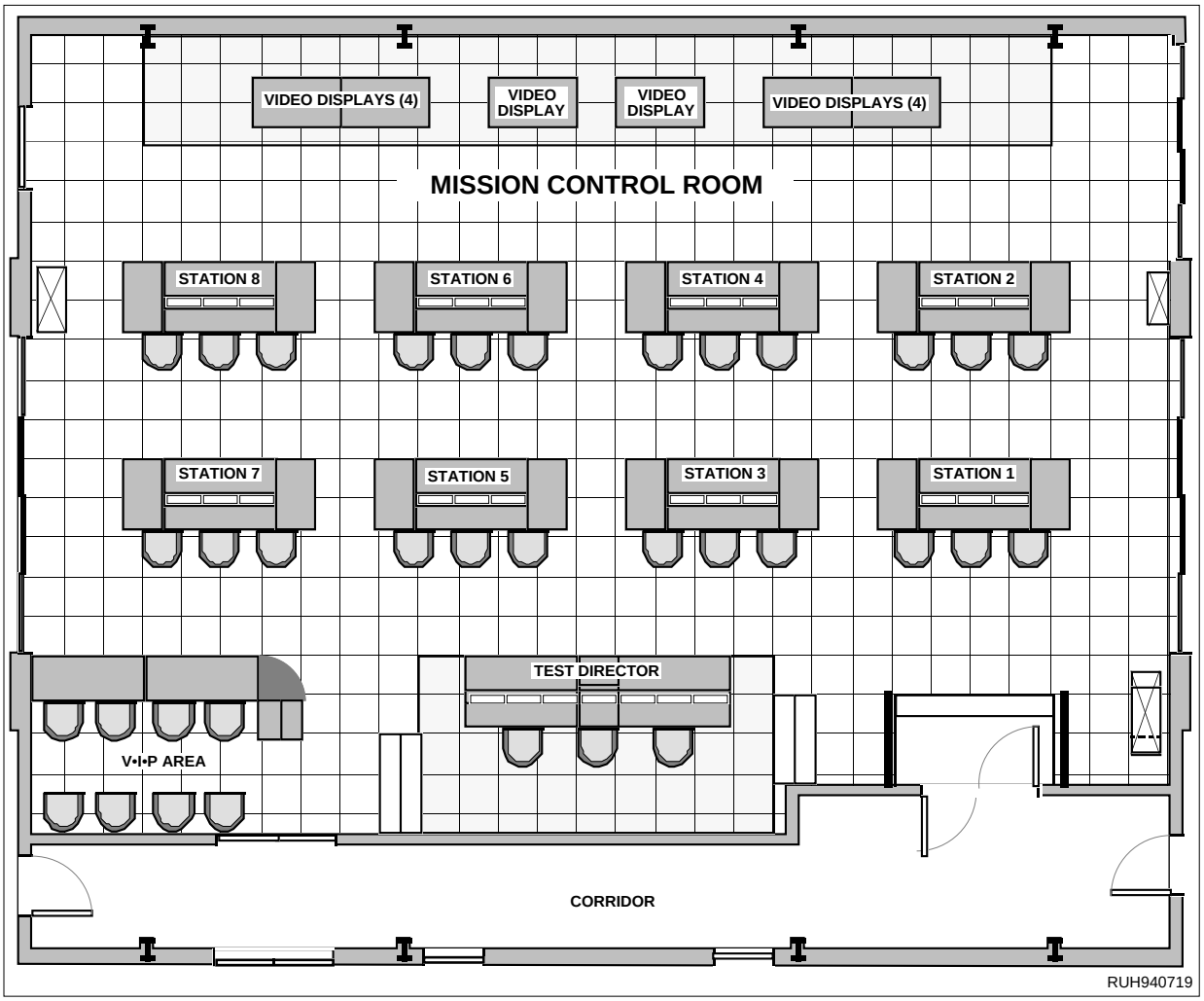

Figure 3-25**.** Layout of RCC Mission Control Room

The eight mission controller stations have a standard configuration for video and data display; however, the selection of information and data displayed is very flexible. The configuration and selection of the displays and data sources can be pre-selected and changed during an operation, if required. Various consoles have Silicon Graphic workstations and/or PC's to provide additional real-time data displays.

Figure 3-26 shows a typical Mission Controller Station with video displays and communications and control devices. The RCC video wall displays are shown in the background.

Figure 3-27 illustrates the data and communications available at each station.

Figure 3-26. Mission Controller Station

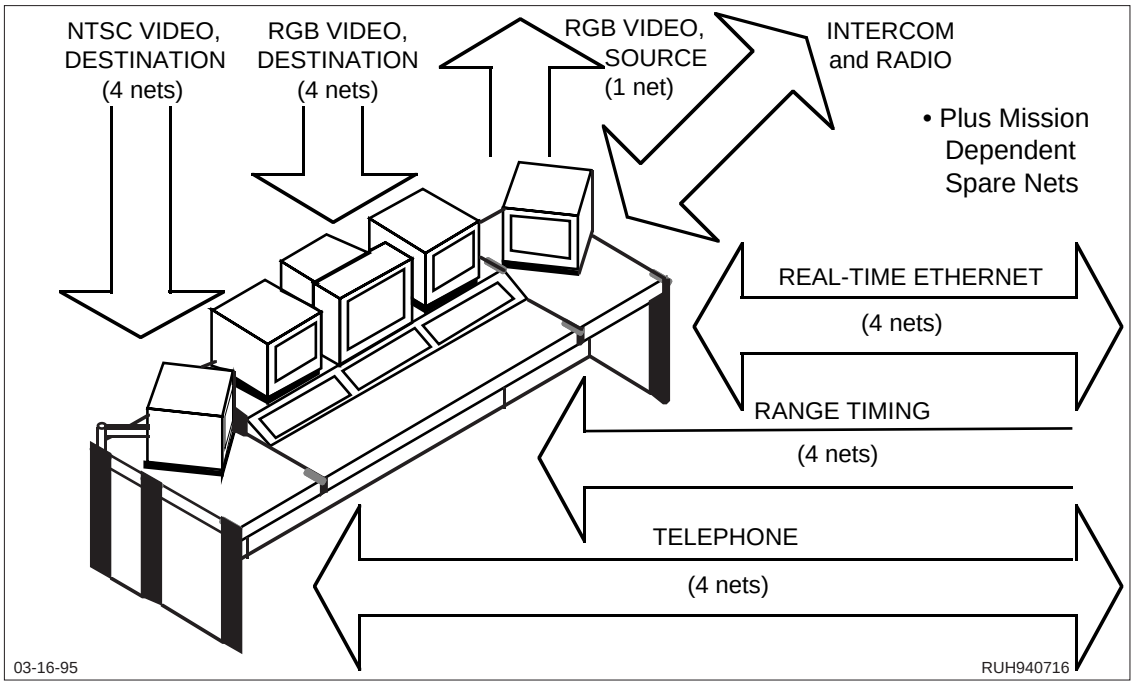

Figure 3-27. Mission Controller Station Data Interfaces

3.2.10.2 Data Acquisition & Processing Room

The Data Acquisition & Processing Room is a side room adjacent to the MCR. Radar, telemetry, and other range data are quality controlled and selected for display from this room. The room is separated from the MCR by a glass wall with sliding glass doors.

3.2.10.3 Range Safety Room

The Range Safety Room is adjacent to the MCR and is the focal point for ground and flight safety operations. The functions performed in the Range Safety Room are wind weighting, monitoring of pre-flight and flight parameters, and control of the Flight Termination System.

The room is separated from the MCR by a glass wall with sliding glass doors.

3.2.10.4 Secure Room

The Secure Room is adjacent to the Range Safety Room and the MCR. A secure environment can be established for encrypted communications systems, if required. User provided equipment can be accommodated.

3.2.10.5 Surveillance & Down Range Communications Room

This room is located adjacent to the Data Acquisition and Processing Room. Surveillance consoles provide communications, computation, and displays for range surveillance and clearance functions. In addition, two remote radar consoles, one for the ASR-7 and one for the Marine Pathfinder radar, provide radar control and range surveillance information. This room is separated from the MCR by a glass wall and sliding glass door.

3.2.10.6 MCR Observation Area

There is a balcony on the third floor overlooking the MCR. The balcony will accommodate approximately 30 visitors.

3.2.10.7 Aeronautical Projects Control Room (APCR)

The APCR on the fourth story provides visual observation of the Research Airport including research runway (04/22) and aeronautical project activities in the surrounding area. The APCR has Mission Controller Consoles, identical to those in the MCR and shown in Figure 3-26 and 3-27, providing communications and data display for monitoring and control of aeronautical projects. In addition to video sources on the video switching network, there are remote controls for runway cameras. Figure 3-28 shows the layout of the APCR.

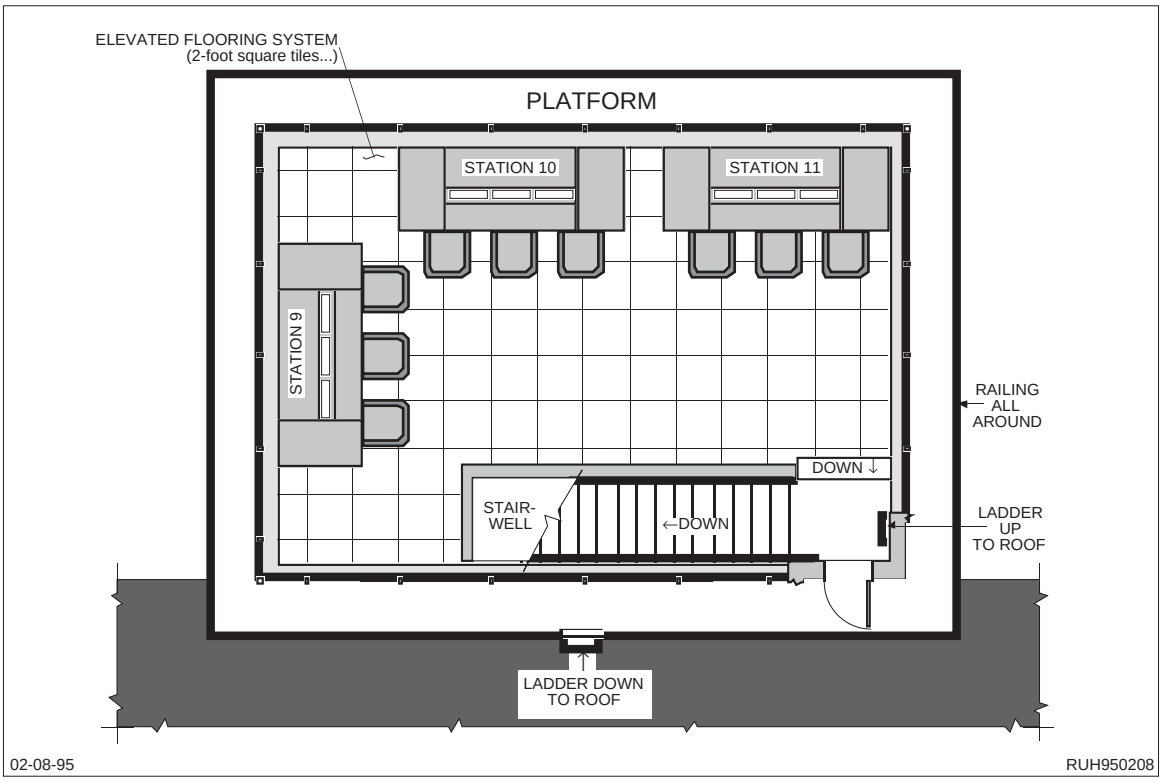

Figure 3-28. RCC 4th Floor Aeronautical Projects Control Room

3.2.10.8 Automatic Data Processing

There are three Encore Concept/32 super-mini computer systems. They are the:

- Real Time Computer System (RTCS) (Encore Concept 32/9705)
- Real Time Backup System (RTBS) (Encore Concept 32/9705)
- Data Reduction Computer System (DRCS) (Encore Concept 32/6780)

The RTCS and RTBS compose the RADAC providing redundant real-time support to the RCC. The DRCS provides general ADP support, primarily data reduction.

The systems use the MPX-32 operating system and there are C and FORTRAN 77+ compilers. The WFF maintains libraries of applications to process User data. The super minicomputers are networked to share data and can provide access via RS-232 ports and modems.

These computers provide post mission data analysis, general data reduction, and range operations support:

- real-time processing
- local and remote multibatch processing
- interactive communications
- time-sharing.

More detailed information concerning computer resources and capabilities is contained in the WFF *Information Processing Laboratory's Data Processing Handbook.*

3.2.10.9 RCC Instrumentation Room

The Instrumentation Room provides the primary interface with internal and external RCC communications, as well as the control of data distribution within the RCC. The primary support instrumentation based in the Instrumentation Room are:

a. Frame for twisted pair interface to external points and distribution of RCC data and communications. These pairs support telephone, range intercom, remote radio circuits, command remoting, tone keying, timing data, radar data, and NASCOM (NASA Communications).

b. Fiber optic cable system interface which supports video, high speed data, and access to the WFF Local Area Network.

c. Video Switching Network. Two level, computer setup and control.

- NTSC: 50 source input by 120 destination output.
- RGB: 50 source input by 100 destination output.

d. NASCOM access. NASCOM access provides real-time voice and data communications through the NASCOM 2000 network with other locations.

e. Programmable Intercom for range communications which provides patchable radio, telephone, SCAMA (Switching, Conferencing, And Monitoring Arrangement), and range operations channels.

3.2.10.10 Weather Forecast Office

The Weather Forecast Office provides meteorological information to the RCC and daily and special forecast support for Range activities. National, regional, and local weather data is available. Data sources include the Automated Field Operations and Services (AFOS), a Lightning Detection System, Field Mills which measure lightning potential, Digital Facsimile (DiFax) for charts and graphs, and a full compliment of local surface instruments to measure wind, temperature, pressure, dew point and cloud height.

A daily forecast briefing covering the upcoming 8 hours is broadcast at 0815 over the WFF closed circuit television. A forecast of the upcoming 36 hours is prepared at 1300 and is available from the Weather Forecast Office. Weather briefings are recorded and accessible by telephone.

Other weather and video switch network information on the WFF Closed Circuit Television network are:

• Satellite derived full disc view of the earth by local feed from NOAA Command Data Acquisition Station at Wallops.

• Weather radar display originating from the National Weather Service (NWS) radar.

• Local weather conditions - including upper winds - based on sensors at WFF.

• National Lightning Detection Network display.

3.2.11 Meteorological Facilities

Various meteorological facilities support launch operations. Fixed, balloon borne, and optical sensors are available for obtaining atmospheric data. Current weather data from weather sensors on the Main Base and Wallops Island are continuously displayed on the local WFF closed circuit TV system, and the data can be made available remotely via modem interfaces. An Ionosphere Sounding Station provides detailed data on the ionosphere characteristics. A Dobson Ozone Spectrophotometer on Wallops Mainland can provide total ozone measurements. Lightning detection systems, described with the Atmospheric Sciences Research Facility in paragraph 3.2.12, display lightning conditions locally and over the United States. An Electric Field Measurement System aids in determining the probability and detecting local lightning activity.

For more detailed descriptions of meteorological systems at Wallops, see the IEB Handbook, Volume V, *Meteorological Facilities and Systems*.

3.2.12 Atmospheric Sciences Research Facility

The NASA Atmospheric Sciences Research Facility (ASRF) on Wallops Mainland has unique capabilities for atmospheric data acquisition, processing, display and recording. The capabilities have made important contributions to the understanding of atmospheric turbulence, cloud and precipitation development and dynamics, lightning discharge characteristics and distribution patterns, as well as the effects of precipitation on the transmission of electromagnetic radiation.

Permanent data acquisition systems available at the ASRF include two high power radar systems (a S-band and a UHF-band), an Environmental Data Acquisition and Recording System (EDARS), and a Dobson Spectrophotometer.

The following lightning characterization systems also support range operations.

- The Lightning Detection and Ranging (LDAR) System is a time of arrival system to measure, locate and display intercloud, intracloud, and cloud-to-ground lightning discharges.
- National Lightning Detection Network (NLDN) is a magnetic direction finder antenna network; displaying cloud-to-ground lightning strike locations within the Continental United States.

- The Extremely Low Frequency (ELF) lightning measurement system detects lightning activity at very long ranges.
- The Electric Field Measurement System is a network of electric field mills covering both the Wallops Island and Wallops Main Base used along with the lightning detection system quantify the probability of local lightning occurrences.
- The Sferics System measures electromagnetic radiation from lightning discharges at different frequencies.

The ASRF is shown in Figure 3-29. Additional information on the ASRF is in *An Experimenter's Guide to the NASA Atmospheric Sciences Research Facility*, March 1994.

Figure 3-29**.** Atmospheric Sciences Research Facility

3.2.13 Optical and TV Facilities

Still, video, and motion picture photography are available to support Wallops Test Range activities and projects. The facilities and equipment includes:

a. Tracking and fixed camera stations: These operations are based primarily on Wallops Island to support rocket and balloon launches. The capabilities are listed in Table 3-11, and the locations on Wallops Island and Mainland are shown on Figure 3-30. Mobile tracking camera equipment can be transported to remote sites to provide coverage.

b. Aerial platforms. Still, motion picture, and video cameras can be installed on several WFF aircraft. A Tyler mount in the UH-1H helicopter provides a stabilized photographic platform.

c. Processing/printing laboratory and limited video editing and reproduction capabilities are available.

Additional information is in IEB Handbook, Volume VI, *Optical and Photographic Systems*.

3.2.14 Recovery Facilities

Recovery services are available for ocean surface, sub-surface, and land operations. These services are provided by government and contract assets.

Visual and electronic search techniques are employed to locate objects impacting on the ocean surface and land areas. Electronic search employs aircraft or ship mounted beacon receiving (homing) equipment in conjunction with homing transmitters attached to the objects to be recovered.

Sub-surface recovery utilizes sonar pinger locating equipment in conjunction with sonar pingers (transmitters) attached to the object to be recovered. Side-scan sonar, underwater TV, and drag line equipment are also employed to locate sub-surface objects for recovery. Retrieval of sub-surface objects can employ scuba and hard hat divers and underwater remote control retrieval units.

3.2.15 WFF Aircraft

WFF has aircraft available for aeronautical research and Wallops Test Range support. These aircraft are described in Table 3-12. For additional information, see the NASA/GSFC/WFF *Aircraft Operations Manual*.

Table 3-11. GSFC/WFF Photo Optical Systems

I.D. No.	Station	System Type	Track Modes	Tracking Rates	Camera Type	Film Type	Lens Focal Length	Environmental Control
#1	Tracking	IFLOT MK1	EL/AZ Manual	22°/sec	MP Film	16-mm	40-inch 80-inch	12-foot Astromode shelter
#2	Tracking	SOT MK 51	EL/AZ Manual	Manual	MP Film TV	16-mm Video	15-inch 12-inch	10-foot Astrodome shelter
#4	Tracking	IFLOT Mk 3A	EL/AZ Manual	30°/sec	MP Film TV	16-mm video	80-inch 40-inch	12-foot Astrodome shelter
#5	Tracking	SOT Mk 51	EL/AZ Manual	Manual	MP Film TV	16-mm video	10 - 20 inch ZOOM	10-foot shelter
#8	Tracking	IFLOT Mk 1	EL/AZ Manual	22°/sec	MP Film	16-mm	40-inch 40-inch	12-foot Astrodome shelter
#9	Tracking	IFLOT Mk 3 (Mobile)	EL/AZ Manual	32°/sec	MP Film	16-mm	40-inch 80-inch	N/A
#11	Tracking	IFLOT Mk1 (Mobile)	EL/AZ Manual	22°/sec	MP Film	16-mm	No camera or lens assigned	N/A
#12	Tracking	IFLOT Mk 1 (Mobile)	EL/AZ Manual	22°/sec	MP Film	16-mm	No camera or lens assigned	N/A
#15	Tracking	IFLOT MK 3	El/AZ Manual	32°/sec	MP Film TV	16-mm video	80-inch 80-inch	12-foot Fixed Shelter
W-60	Fixed	Stationary Mount	Fixed	N/A	MP Film Sequence Film	16-mm 70-mm	12-mm to 12-in 6- to 12-inch	10-foot Fixed Shelter
W-115	Fixed	Stationary Mount	Fixed	N/A	MP Film Sequence Film	16-mm 70-mm	12-mm to 12-in 6- to 12-inch	10-foot Fixed Shelter
Y-110	Fixed	Stationary Mount	Fixed	N/A	MP Film Sequence Film	16-mm 70-mm	12-mm to 12-in 6- to 12-inch	10-foot Fixed Shelter

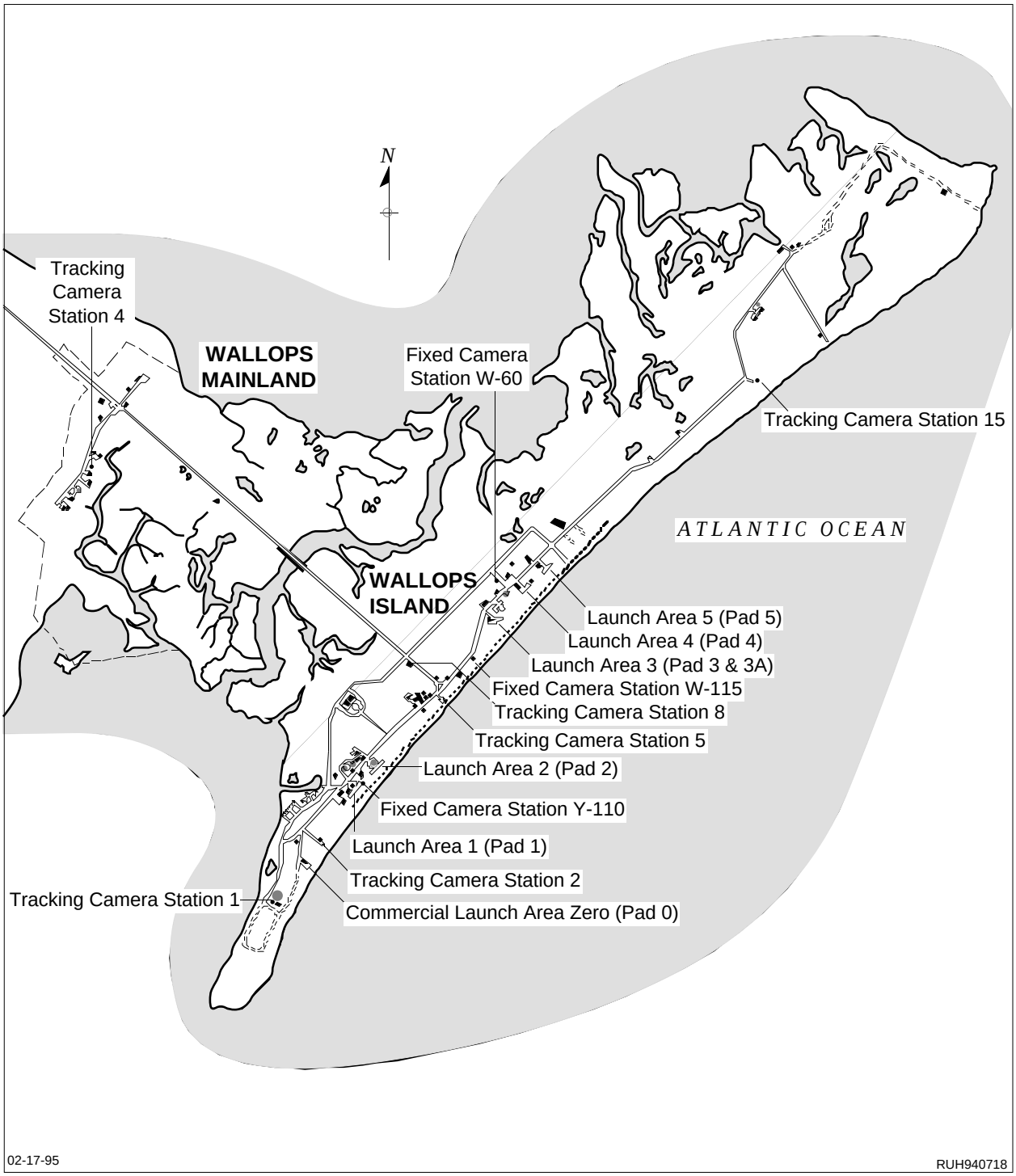

Figure 3-30. Optical Tracking Stations at Wallops Island and Mainland

Table 3-12.
Wallops Flight Facility Aircraft

Aircraft	Characteristics
 Lockheed P-3B Orion (N426NA)	• 3,800 nm/12 hours range/endurance • maximum 30,000 ft altitude • multiple instrumentation ports, airborne radar, and special features to support remote sensing and instrumentation development • capable of world-wide missions
 Lockheed Hercules C-130Q (N427NA)	• 3,400 nm/12 hours range/endurance • maximum 30,000 ft altitude • airborne radar, multiple instrumentation ports, remote sensing, over-the-horizon command and control relay • cargo capability • capable of world-wide missions
 T-39E Sabreliner (N425NA)	• 1,400 nm/3.5 hours range/endurance • maximum 37,000 ft altitude • MACH .82 • primarily for remote sensing • various program support missions including photography, simulated targeting, telemetry relay, and instrumentation development
 Bell UH-1H Helicopter (N415NA)	• 400 nm/2.5 hours range/endurance • maximum 10,000 ft altitude • primarily for remote sensing • platform for various experiments including photographic and TV missions
 Fokker F-27F (N432NA)	• 1800 nm/8 hours range endurance • maximum 28,000 ft altitude • primary range surveillance aircraft • maximum payload - 16,000 lbs.

3.2.16 Mechanical and Electrical Fabrication and Testing

A fully equipped machine shop can provide electronic, electrical and mechanical support. The 26,000 square foot machine shop includes sheet metal fabrication, welding, and heat treating facilities. Capabilities include developing and fabricating mechanical systems, optical instrumentation, and payload components for flight research. There are test and evaluation facilities providing sounding rocket payload, environment, and mass property testing. The capabilities of these facilities primarily support the NASA Sounding Rocket Program; therefore, the facilities should only be considered for emergency services by a Range User.

3.2.17 Dynamic Balance Facility

The Dynamic Balance Facility, housed in buildings V-45, V-50 and V-55, is located on Wallops Island, north of the launch areas. See Figure 3-10 for location. The facility is used in support of sounding rockets, probes, re-entries, and orbital missions to:

- locate the center of gravity
- determine weight
- achieve static and dynamic balance

The Blockhouse Control Building, V-50, is located between buildings V-45 and V-55, which are 800 ft apart for safety purposes.

Building V-45 is 60 ft x 80 ft with a 23 ft hoist height. It contains one 10 ton bridge crane hoist. Building V-55 is 40 ft x 60 ft with a 33 ft hoist height. It contains one 20 ton bridge crane.

Building V-55 houses the Trebel FVD-3000 Aerospace Balancing Machine, the largest of its kind in the world.

A Trebel FVD 1000 Aerospace Balancing Machine is located in building V-45. These machines are remotely operated and monitored from the V-50 Control Center. These force-measuring machines have the following capacities:

Table 3-13.
Vertical Trebel Balancers

Vertical Trebel Balancer (FVD-3000)	
Test specimen weight:	50 to 6,000 lb; 35,000 lb maximum at reduced speeds
Balancing velocity:	50 to 1,000 rpm
Maximum test specimen size:	10 ft diameter (15 ft with modifications) Maximum height
Vertical Trebel Balancer (FVD-1000)	
Test specimen weight	50 to 7,000 lb
Balancing velocity:	50 to 1,000 rpm
Maximum test specimen size:	Unrestricted diameter Maximum height 20 ft

A selection of turntable-workpiece standard adapters to fit the 48 inch diameter table are available.

Three vertical balancers are located in building V-45 and are remotely operated and monitored from V-50. They are used primarily for small or medium test setups with restricted diameters. These displacement type machines are the softbearing amplitude type. They have the following capacities:

Table 3-14.
Vertical Gisholt Balancers

Test specimen weight:	10 to 300 lb, 40 to 2,000 lb, 50 to 3,300 lb
Balancing velocities:	80 to 1,000 rpm
Maximum test specimen size:	46 inch diameter by 20 ft long

A variety of electronic scales is available to measure weight from 0.1 g to 22,676 kg. The Toledo Scale Corporation Portable System determines weight and center of gravity of the various rocket motor components. The system specifications are:

Table 3-15.
Toledo Scale System

Maximum weight capacity:	900 pound
Weight accuracy:	0.1% or 1 pound, whichever is greater
CG accuracy:	±3 inch over 250 pounds, ±2 inch over 500 pounds

3.2.18 Metrology

There is a Quality and Verification Laboratory equipped to perform repair and calibration of test instruments. Certification of required circuit testing equipment is performed. The Laboratory maintains a standards laboratory for required standards. The equipment in the standards laboratory is traceable to the National Institute of Standards and Testing (NIST). These standards are part of a mandatory recall program for recalibration and certification.

3.2.19 Hazardous Material Storage

- Liquid Storage

There are facilities located on Wallops Island for the temporary storage of hazardous liquids, such as propellants and purging gasses.

- Rocket Motors

There are above ground and earthen covered storage magazines on Wallops Main Base for the storage of Class 1.3 and 1.4 explosives. There are facilities for the non-destructive testing of ordnance and rocket motors.

On Wallops Island, there are two rocket motor storage facilities. There is a facility for Class 1.1 rocket motor storage, and there is an above ground storage facility on the north end of Wallops Island for the storage of all classes of rocket motors. See Figure 3-10 for the location of this facility.

3.2.20 Mobile Range Systems

Mobile radar, telemetry, and data systems - similar to capabilities permanently available at the Wallops Test Range - have been developed which can be transported to offsite locations. Campaigns have been conducted in Arctic and Antarctic regions, South America, Africa, Europe, Australia, and even at sea. WFF personnel have extensive experience in planning and conducting mobile campaigns and developing equipment and systems to support these operations.

Mobile systems include:

- C-band radar
- data acquisition and recording
- payload processing
- launchers
- orbital tracking
- communications
- real-time data processing and display
- range safety
- flight termination system
- telemetry
- meteorological
- power
- timing
- optical tracking
- command
- control center
- recovery

Additional information on mobile telemetry capabilities is in paragraph 3.2.2, and additional information on mobile radar capabilities is in paragraph 3.2.3.

Figure 3-31. Range Equipment at Woomera, Australia

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Section Four: Wallops Test Range Administration and Logistics

4.1 General

This section describes applicable administrative and logistics policy and procedures.

4.1.1 Access

Access to the Main Base and to the Wallops Island-Mainland complex is controlled by a vehicle pass, badge, and identification system. Visits to WFF should be coordinated with the RSM.

4.1.2 Working Hours

The normal workday for WFF is 0800 to 1630 Monday through Friday. There are work limitations established for safety purposes. Coordination of the work schedule with the RSM is necessary to ensure access to required facilities and the availability of necessary technical personnel.

4.1.3 Visiting Aircraft

Visiting aviators on official United States Government business are required to obtain a "Prior Permission Required" (PPR) number from the Wallops Airport Manager (or in his absence, from the Head, Operations Management Section) prior to flying into WFF. The PPR should be obtained at least 24 hours before the scheduled arrival. Upon arrival in Wallops airspace, the visiting aircraft should communicate with the Control Tower operator on UNICOM (UHF 126.5 MHz or 394.3 MHz). The call sign is "Wallops UNICOM" . The Range User must give the assigned PPR to the Control Tower operator before permission is given to land. The Control Tower is manned 0700 to 1730, Monday through Friday, on normal workdays and at other times to support specific missions.

4.1.4 Cafeteria

The Main Base Cafeteria is located in building E-2. Breakfast (0700 to 0800) and lunch (1100 to 1300) are served on normal workdays only.

4.1.5 Communications

4.1.5.1 Telephone

Federal Telecommunications System (FTS - 2000) service is provided for official United States Government business. Modem support for Range User computers may be provided through the digital PBX system. Pay phones are located in front of the cafeteria and in the dormitories. The WFF operator is available during normal working hours at (757) 824-1000.

4.1.5.2 Internet

Connections to Internet can be provided.

4.1.5.3 Fax

Fax service is available.

4.1.6 Smoking

Smoking is prohibited in all WFF buildings, launch pads, aircraft, and aircraft support areas.

4.1.7 Industrial Safety

Industrial safety procedures are typical of those enforced at other United States Government facilities. In addition, personnel are expected to obey all control signals and roadblocks on the airfield and launch range.

4.1.8 Fire Protection

There are two fire stations: one on the Main Base and one on Wallops Island. They are manned by fully trained firefighters/emergency medical technicians 24 hours per day. Each station is equipped to meet the emergency response requirements of WFF.

4.1.9 Medical Facilities

The Health Clinic on the Main Base, building F-160, is available to provide limited medical services in the event of an emergency during working hours. Ambulance services are available. There are two local hospitals:

a. Northampton-Accomack Memorial (NAM) Hospital is approximately 40 miles to the south in Nassawadox, Virginia

b. Peninsula Regional Medical Center (PRMC) is located approximately 40 miles to the north in Salisbury, Maryland. Medivac helicopter service may be requested through the WFF Fire Department.

4.1.10 Shipping

Various shipping services are available including United Parcel Service, Federal Express, and the United States Postal Service. The Range User should use the following information when mailing correspondence or shipping equipment for official project business:

MAIL ADDRESS	Name/GSFC Code Number NASA Goddard Space Flight Center Wallops Flight Facility Wallops Island, Virginia 23337 USA
FREIGHT DESTINATION ADDRESS:	Name/GSFC Code Number c/o Receiving Officer Goddard Space Flight Center Wallops Flight Facility Building F-19 Wallops Island, Virginia 23337 USA

4.1.11 Motor Freight Truck Services

Most cargo and freight is received at WFF Main Base, building F-19. However, construction material is delivered to the site, and commercial shipments may be received directly by commercial tenant users.

Inbound shipments of Class “A” and “B” explosives and other designated hazardous materials require advance notice prior to arrival. The delivering carrier’s representative should give advance notice by telephone to the Launch Vehicle and Recovery Systems Group (LV&RSG/Code 823), (757) 824-1433. The LV&RSG will furnish onsite escort, unloading, inspection, and shipment acceptance.

Normal receiving hours are from 0800 to 1430 (for truckloads) and 0800 to 1600 (for partial loads), Monday through Friday, excluding holidays.

4.1.12 Air Cargo

Air cargo deliveries require special consideration and must be discussed with the assigned RSM and/or the Airport Manager.

GSFC/WFF Airport Manager
Phone (757) 824-1654
Fax (757) 824-2378

4.1.13 Air Freight Services

The nearest commercial air freight service is at the Salisbury-Wicomico County Regional Airport, Salisbury, Maryland.

4.1.14 Hazardous Material

All hazardous material must be packaged to conform with applicable Department of Transportation regulations. A Material Safety Data Sheet (MSDS) must accompany all hazardous materials shipped to WFF.

All hazardous materials shall be disposed of in accordance with the Virginia Department of Environmental Quality Regulations. The Range User must provide a "Hazardous Waste Disposal Inventory," NASA Form WI-1550, to the Environmental Branch (Code 205.3), for disposal of all hazardous material.

Radioactive sources require approval from the Safety, Environmental and Security Office (Code 205.0) prior to arrival. The Range User must provide the proper forms requesting the use of a radioactive material at WFF, including license information, to the RSM at least 90 days prior to the shipment/arrival of the source. The GSFC Handbook, GHB 1860.1B, *Radiation Protection - Ionizing Radiation,* defines procedures and provides the needed forms.

4.1.15 Material Handling Equipment

A variety of material handling equipment is available. These include fork-lifts, overhead hoists, and material moving equipment. The Range User should provide required information regarding the testing and certification of slings, fixtures, and other User furnished lifting devices. Table 4-1 lists the primary material handling equipment available at WFF.

Table 4-1.
Material Handling Equipment

Quantity	Material Handling Equipment
1	60 ton hydraulic truck crane with 118 foot main boom
1	28 ton hydraulic truck crane with 70 foot main boom
1	95 foot basket truck
1	65 foot basket truck
several	electric fork lift
several	forklifts under 8,000 pounds
6	8,000 pound forklift
1	10,000 pound forklift
2	18,000 pound forklift
2	stakebody truck with 2,000 pound hydraulic lift gate
1	lowboy trailer with hydraulic tail deck
1	van truck
2	truck tractor
several	handtrucks
several	pallet jacks

4.1.16 Customs

International shipments should clear United States Customs before arrival at WFF. Arrangements for shipments directly from overseas into WFF must be coordinated and approved by United States Customs prior to shipment.

4.1.17 Post Office

A United States Post Office is located in the west side of building E-7 on Main Base. The address is Wallops Island, Virginia 23337 USA.

4.2 Foreign Nationals

Prior approval must be obtained from NASA before a visit by foreign nationals. The individuals must provide a visit request to the RSM. A list of information required to be provided for the visit can be obtained from the RSM and should be provided a minimum of 3 weeks before the visit.

4.3 Public Affairs Support

The Wallops Public Affairs Office (Code 130) is available to support Range Users with media and guest relations operations. Initial requests for PAO support can be made through the RSM.

4.4 NASA Visitors Center

A Wallops Flight Facility Visitor Center and Gift Shop, Figure 4-1, is located on Virginia Route 175 about 1 mile east of the Wallops Main Gate. The Visitor Center, Gift Shop, and Teacher Resource Lab are part of the Robert L. Kreiger Education Center. A collection of spacecraft and flight articles as well as exhibits about United States space flight program are on display. Special movies and video presentations can be viewed, and special events such as model rocket launches are scheduled. No admission is charged. The Visitor Center auditorium may be used for media and guest relations activities.

Figure 4-1. Wallops Visitor Center and Gift Shop

Section Five: Range Safety Policies

5.1 Range Safety Organization

The Suborbital Projects and Operations Directorate (Code 800) is charged with the responsibility for implementing the safety policy and criteria for the Wallops Test Range. These policies and criteria are defined in GMI 1771.1, *Range Safety Policies and Criteria for GSFC/WFF* and the *Range Safety Manual for GSFC/WFF.*

Aviation safety policy and procedures for the operation of aircraft at WFF are covered in the GSFC/WFF *Aircraft Operations Manual* and the *GSFC/WFF Airport Operations Manual*.

5.2 Range User's Pre-Arrival Requirements

Range Users should design vehicle and payload systems to fully implement and conform with the policies and criteria established by WFF.

Range Users must identify vehicle or payload systems and/or operational requirements which cannot meet the GSFC/WFF and NASA safety policies and criteria.

Range Users must provide a safety data package containing the data defined in paragraph 8 of the *Range Safety Manual for GSFC/WFF* and according to the schedule in 2.4.5.

5.3 Ground Safety

Specific policies and criteria, such as radiation exposure limits, power switching, multiple operations, electroexplosive circuit requirements, electrical storm criteria, RF restrictions, personnel requirements, radioactive sources, and pressure vessels, are provided in GMI 1771.1, *Range Safety Policies and Criteria for GSFC/WFF* and the *Range Safety Manual for GSFC/WFF.* Radiation protection requirements are in the GHB 1860.1B, NASA/GSFC Handbook, *Radiation Protection - Ionizing Radiation*. All hazardous procedures must be approved by Ground Safety Group (Code 821). The approval must be given prior to use. All hazardous operations must be performed by certified personnel. Ground Safety Group must certify personnel or approve the certification of Range User personnel.

A Ground Safety Plan is prepared by the Ground Safety Group (Code 821) and published as part of the Operations and Safety Directive (OSD) before any Range User operations are conducted at the Test Range.

5.4 Flight Safety

Specific flight safety policies and criteria for impacts, land overflights, ship and aircraft hazard areas are defined in GMI 1771.1, *Range Safety Policies and Criteria for GSFC/WFF and the Range Safety Manual for GSFC/WFF*. All flights will be planned to minimize the risks involved while enhancing the probability for attaining mission objectives.

A Flight Safety Plan is prepared by the Flight Safety Group(Code 821) and is published as part of the OSD prior to the launch operation. The Flight Safety Plan will include the specific flight limits, impact limits, ship and aircraft hazard areas, and mission unique requirements.

Appendix A
Abbreviation and Acronyms

AFOS	Automated Field Operations and Services
AML	Astro Meteorological Launcher
ARC	Atlantic Research Corporation launcher
ADP	Automatic Data Processing
ASRF	Atmospheric Sciences Research Facility
AZ	azimuth
CD ROM	Compact Disk - Read Only Memory
CSLA	Commercial Space Launch Act, Public Law 98-575
csc^2	$cosecant^2$
dB	decibel
dBi	decibel isotropic
dBm	decibels above (or below) 1 milliwatt
dBmi	decibels milli-isotropic
DMR	Detailed Mission Requirements Document
DRCS	Data Reduction Computer System
EDARS	Environmental Data Acquisition and Recording System
EIRP	effective isotropic radiated power
ELF	Extremely Low Frequency
ELV	expendable launch vehicle
ERD	WFF Environmental Resources Document
FACSFAC	Fleet Area Control and Surveillance Facility
FAX	facsimile transmission
FM	frequency modulation
ft	foot or feet
FTS	Federal Telecommunication System
GHz	gigahertz
GMI	Goddard Management Instruction
GPS	Global Positioning System
GSFC	Goddard Space Flight Center
G/T	Gain/System Noise Temperature or Figure of Merit
HAD	Improved High Altitude Diagnostic Launcher

HF	high frequency
HTA	Host-Tenant Annex
IEB	Instrumentation Engineering Branch
IIP/CD	Instantaneous Impact Prediction/Command Destruct
ILS	Instrument Landing System
InMarSat	International Marine Satellite
INS	Inertial Navigation System
IRIG	Inter-Range Instrumentation Group (United States Government Agency)
ISA	Individual Support Agreement
kg	kilogram
KPPS	thousand pulses per second
lbs	pounds
LDAR	Lightening Detection and Ranging System
LGTAS	Low Gain Telemetry Antenna System
LHC	Left Hand Circular
LTAS	Launch Trajectory Acquisition System
LTS	Laser Tracking System
m	meter or meters
MAS	Meteorological Antenna System
MCR	Mission Control Room
MDDF	Minimum Delay Data Format
MGTAS	Medium Gain Telemetry Antenna System
MHz	megahertz
MLS	Microwave Landing System
MOA	Memorandum of Agreement
MRR	Mission Requirements Request
MTS	Master Timing Station
n/a	not applicable
NACA	National Advisory Committee for Aeronautics
NAM	Northampton-Accomack Memorial Hospital, Nassawadox, Virginia
NASA	National Aeronautics and Space Administration
NASCOM	NASA Communications
NAWC	Naval Advanced Warfare Center
NEPA	National Environmental Policy Act
NLDN	National Lightning Detection Network

NOAA	National Oceanographic and Atmospheric Administration
NORAD	North American Aerospace Defense Command
NSBF	National Scientific Balloon Facility, Palestine, Texas
^{o}K	degrees kelvin
NTSC	National Television System Committee
OSD	Operations Safety Directive
PAPI	Precision Approach Path Indicators
PBX	Private Branch Exchange
PCM	pulse code modulation
PFRR	Poker Flat Research Range, Fairbanks, Alaska
PI/PRD/OR	Program Introduction/Program Requirements Document/Operations Requirements
PPR	Prior Permission Required
PPS	pulses per second
PRMC	Peninsula Regional Medical Center, Salisbury, Maryland
PSCN	Program Support Communications Network
R&D	research and development
RADAC	Range Data Acquisition & Computation System
RCC	Range Control Center
RCC-DG	Range Commanders Council-Documentation Group
RF	Radio Frequency
RFI	Radio-Frequency Interference
RGB	Red Green Blue
RHC	Right Hand Circular
RSM	Range Support Manager
RSO	Range Safety Officer
RTBS	Real Time Backup System
RTCS	Real Time Computer System
SCAMA	Switching, Conferencing And Monitoring Arrangement
SPOD	Suborbital Projects and Operations Directorate (Code 800)
sq/ft	square feet
SSDEC	Ship Self Defense Engineering Center
STS	Space Transportation System
TOTS	Transportable Orbital Tracking Station
T.O.Y.	Time-of-Year
UDS	Universal Documentation system

UHF	ultra high frequency
UNICOM	Universal communications
UPS	Uninterruptible Power System
USCG	United States Coast Guard
UTC	Universal Time Coordinated
VHF	very high frequency
W	watt
WFF	Wallops Flight Facility
WOTS	Wallops Orbital Tracking Station

Appendix B
References

1. GMI 1300.2, Goddard Management Instruction, *Policies and Procedures for the Use of the GSFC/WFF Test Range*

2. GMI 1771.1, *Range Safety Policies and Criteria for GSFC/WFF*

3. RSM-93, *Range Safety Manual for GSFC/WFF* and *Supplement to Range Safety Manual (RSM-93) for GSFC/WFF (additional requirements for Pegasus)*

4. NASA/GSFC/WFF *Airport Operations Manual*

5. NASA/GSFC/WFF *Aircraft Operations Manual*

6. Instrumentation Engineering Branch Handbook Series, Volumes I - X:

    a. Volume I: *Radar Facilities and Systems*
    b. Volume II: *Telemetry Facilities and Systems*
    c. Volume III: *Data Systems and Facilities*
    d. Volume IV: *Communications Facilities and Systems*
    e. Volume V: *Meteorological Facilities and Systems*
    f. Volume VI: *Optical and Photographic Systems*
    g. Volume VII: *Aircraft Instrumentation Systems*
    h. Volume VIII: *Quality Verification Facilities and Systems*
    i. Volume IX: *Computer Systems*
    j. Volume X: *Poker Flat Research Range Systems*
    k. *Abstract of Instrumentation Handbooks, Vols I through X*

7. NASA GSFC/Wallops Flight Facility *Tracking And Data Acquisition Systems Capabilities*

8. NASA GSFC/WFF *Timing System Synchronization Procedures Manual*, Nov. 93

9. GSFC/WFF *Information Processing Laboratory's Data Processing Handbook*

10. *NASA Sounding Rocket User's Handbook*

11. NASA/GSFC/WFF *Host/Tenant Frequency Utilization Management Manual*

12. GHB 1860.1B, NASA/GSFC Handbook, *Radiation Protection - Ionizing Radiation*

13. *Geodetic Coordinates Manual For NASA Goddard Space Flight Center - Wallops Flight Facility*

14. GHB 8800.2, NASA/GSFC Handbook, *Goddard Space Flight Center Environmental Handbook*

15. 14 CFR 1216.3 *NASA Procedures for Implementing the National Environmental Policy Act (NEPA)*

16. NHB 8800.11, *Implementing The Provisions Of The National Environmental Policy Act*

17. 40 CFR Parts 1500-1508, Council on Environmental Quality. *Regulations For Implementing The Procedural Provisions Of The National Environmental Policy Act*

18 GSFC/WFF *Environmental Resources Document*

19. *An Experimenter's Guide to the NASA Atmospheric Sciences Research Facility*, March 1994

20. *GSFC/Wallops Flight Facility Space Utilization Handbook*, Facilities Engineering Branch

21. *Range Commanders Council - Documentation Group (RCC-DG) Document 501-90, volume I, II, and III*